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FORECASTING VSI/SSB TAKE-RATES FOR
ENLISTED MARINE CORPS PERSONNEL

by

Mark L. Noblit

March 1993

Thesis Advisor: Stephen L. Mehay

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This thesis involves the development of multivariate models to estimate probabilities that enlisted Marines take the Voluntary Separation Incentive/Special Separation Benefit (VSI/SSB) program, and also to forecast the distribution of "takers" between the VSI and the SSB. The data were obtained from the Headquarters Marine Corps enlisted master file which includes demographic and military background information on all Marines who were eligible for the VSI/SSB between 15 January and 30 June 1992. The theory of labor supply and occupational choice provides the theoretical framework for the model. The probability of taking the program is modeled as a function of military compensation, expected civilian earnings, and other non-pecuniary factors. Logit regression equations are applied to develop "best fit" equations that predict the probability that a Marine takes the VSI/SSB, and the probability that a program taker will choose the SSB. Empirical results indicate that paygrade and military occupation are the most important factors in predicting the probability of taking the VSI/SSB. Gender, race, job assignment, location, time-in-grade, promotion rate, and the number of years until the end of active service had significant but smaller effects on predicted probabilities. Lower paygrades, no college education, less time-in-grade, and a faster promotion rate are factors that increase the probability that a Marine chooses the SSB.

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Forecasting VSI/SSB Take-Rates For Enlisted Marine Corps Personnel

by

Mark L. Noblit
Major, United States Marine Corps
B.A., Villanova University, 1980

Submitted in partial fulfillment
of the requirements for the degree of

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March 1993

Author: _____
Mark L. Noblit

Approved by: _____
Stephen L. Mehay, Thesis Advisor

_____
Mark J. Eitelberg, Second Reader

_____
David R. Whipple, Chairman
Department of Administrative Sciences

ABSTRACT

This thesis involves the development of multivariate models to estimate probabilities that enlisted Marines take the Voluntary Separation Incentive/Special Separation Benefit (VSI/SSB) program, and also to forecast the distribution of "takers" between the VSI and the SSB programs. The data were taken from the Headquarters Marine Corps Enlisted Master File which includes individual and military background information on all Marines who were eligible for the VSI/SSB between 15 January and 30 June 1992. The theory of labor supply and occupational choice provides the theoretical framework for the model. The probability of taking the program is modeled as a function of military compensation, expected civilian earnings, and other non-pecuniary factors. Logit regression equations are applied to develop "best fit" equations that predict the probability eligible enlisted Marines will take the VSI/SSB, and the probability that a program taker will choose the SSB. Empirical results indicate that paygrade and military occupation are the most important factors in predicting the probability of taking the VSI/SSB. Gender, race, job assignment, location, time-in-grade, promotion rate, and years until the end of active service had significant but smaller effects on predicted probabilities. Lower paygrades, no college education, less time-in-grade, and a faster promotion rate increase the probability of a Marine taking the SSB.

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I. INTRODUCTION

A. BACKGROUND

1. Purpose of Thesis

The Voluntary Separation Incentive/Special Separation Benefit Program (VSI/SSB) contained in the 1992 Defense Authorization Bill has become an important policy tool of the Department of Defense's force reduction strategy. All of the military services have used this program to support their force reduction goals or to assist in establishing a desired force structure. Effective planning and implementation of the VSI/SSB program as a manpower management tool depends on the ability of each service to forecast its "take-rate" and the distribution of the "take-rate" between VSI and SSB.

This thesis provides an analysis of the results obtained by the Marine Corps from the initial offerings of the VSI/SSB to eligible enlisted service members. The analysis involves the specification and estimation of multivariate models to explain the probability of acceptance of separation benefits. These equations can then be used by manpower planners to forecast the future "take-rates" among different enlisted groups that are offered the program.

2. The Structure of the VSI/SSB Program

From 1992 through the end of fiscal 1995, current plans call for the military services to be reduced by approximately 25 percent from just over two million members to 1.65 million. Some--but not all--of this decrease of almost 400,000 men and women

will be accomplished by normal attrition and by substantially reducing the number of new recruits. The military services could reach their end-strength targets through these mechanical means, but the result would be a large imbalance in the number of mid-careerists. [Ref. 1]

In a force structure with smaller requirements, an overabundance of mid-careerists would mean much slower promotions and reduced job satisfaction as experienced people wait longer for more challenging jobs. Because fewer people would be recruited over the next five years, the military would face a shortage of experienced enlisted personnel after the end of the century when many of today's experienced service members will have retired. Additionally, the military would pay more for a more senior force over the next several years.

Alternatively, the military could involuntary separate large numbers of mid-careerists. These are the dedicated men and women who have served their nation well and have made significant commitments and sacrifices to their branch of service. A large number of involuntary separations could adversely affect the morale, recruitment, and quality of the future All-Volunteer Force.

To resolve this dilemma, Congress authorized the Department of Defense (DoD) in the 1992 Defense Authorization Bill to offer financial incentives that would induce mid-career members to separate voluntarily. This legislation established the Voluntary Separation Incentive/Special Separation Benefit (VSI/SSB) Program.

The Department of Defense received authorization to use the VSI/SSB program to achieve either-end strength reduction or force-shaping goals. The distinction

between the two is that losses are not replaced in the case of end-strength reduction. With force shaping, losses must be made up through increases in accessions or reenlistments. DoD was also authorized to establish the eligibility criteria. To be eligible, a service member must meet the following criteria:

1. The service member must have served on active duty for more than six years before 5 December 1992.

2. The service member must have completed his or her initial term of enlistment or obligation including any extensions.

3. The service member must have served at least five years of continuous active duty immediately preceding the date of separation.

4. The service member must have served on active duty, upon separation, for less than 20 years and not be eligible for retired or retainer pay.

5. The service member must be a regular or a reservist on the active duty list.

The service secretaries were permitted to prescribe other requirements based on factors such as years of service, skill or rating, grade or rank, and remaining period of obligated service. Participation by members who meet all of the criteria is voluntary. Service members who volunteer for the program must separate before 30 September 1995, when authority for the program expires. [Ref. 2]

A member who is approved for separation under the VSI receives an amount equal to 2.5 percent of his or her monthly basic pay on the date appointed, enlisted, or transferred to the Individual Ready Reserve (IRR), multiplied by twelve and multiplied again by his or her years of service (YOS) (Annual Payment= 2.5 percent x final monthly basic pay x 12 months x YOS). Payments are made annually for twice the number of years the service member was on active duty.

Voluntary Separation Incentive payments will be discontinued if the service member is separated from the IRR except under the following conditions:

1. In the event of the service member's death, VSI annual payments will continue to beneficiaries designated by the service member for the remaining period.

2. If the service member becomes ineligible to continue to serve in the IRR due to medical or age limitations.

The Special Separation Benefit (SSB) provides eligible service members a lump-sum payment equal to 15 percent of the monthly basic pay received on the date of his or her separation, multiplied by twelve and multiplied again by his or her years of service (Lump Sum Payment= 15 percent x final monthly basic pay x 12 months x YOS). Service members will receive the same transition benefits and services as members involuntarily separated and they must agree to serve in the IRR for a period of not less than three years following separation from active duty.

3. Marine Corps Implementation of the VSI/SSB Program

The current strategy of the Marine Corps is to use the VSI/SSB program as a force management tool to shape and balance the force structure rather than as an end-strength reduction tool. Since January 1992, the Marine Corps has offered the program in three separate phases. [Ref. 3]

Phase I began on 15 January and was extended through 15 April 1992. Marine Corps planners faced two problems at the start of phase I. First, they had not yet received a target force for fiscal 1992 consistent with the work done by the Force

Structure Planning Group (FSPG)[1]. The second problem was that the Secretary of the Navy established guidance that discouraged disapproval of a request for VSI/SSB once it had been offered to an individual. [Ref. 3] Despite these problems, the Marine Corps was able to implement phase I by:

1. Limiting the eligible population to the authorized fiscal 1992 participation level;
2. Targeting military occupational specialties (MOSs) that were obsolete or were rapidly becoming obsolete by equipment modernization and the new force structure. [Ref. 4]

The results from phase I indicated a much lower participation rate than expected.

Because of the initially low participation rate, Phase II (offered from 20 March to 15 June 1992) significantly increased the number of eligible occupational specialties by targeting grade and year-of-service overages [Ref. 5]. The intended population for phase II was primarily corporals approaching service limitations in slow-promoting MOSs and sergeants who were not yet considered for promotion and were approaching the 13-year service limitation.

Phase III, initiated between 20 May and 30 June 1992, was similar to phase II in that the program was extended to staff sergeants and gunnery sergeants in selected over-strength skills in which there was promotion stagnation. The purpose of targeting this group was that the Marine Corps was preparing to no longer allow staff sergeants,

[1]The Force Structure Planning Group (FSPG) was an ad hoc committee tasked by the Commandant of the Marine Corps to define the most effective and capable force structure for the Marine Corps at the reduced manning level of 159,100 active duty marines. The structure developed by the committee was to be the focal point for the development of a force shaping strategy by manpower planners.

passed for promotion, to stay in for 20 years of service. This policy would, however, allow staff sergeants to remain for 20 years if they received their second pass after a certain year of service. The problem was that promotion to gunnery sergeant had slowed so much that a substantial number of staff sergeants were already beyond the year of service points that were considered as the cut-offs for the twice-failed selection and out policy. [Ref. 6]

B. THESIS OBJECTIVES

During the three phases the program was offered, manpower planners did not have an accurate means by which to forecast how many of those eligible would apply for the program. By the end of phase III, the VSI/SSB program was offered to a representative cross-section of marines in all eligible grades, years of service, and occupational specialties. The data from these results can now be analyzed to determine which variables explain program choice and to develop empirical models that forecast "take-rates."

The theoretical framework for conducting the analysis is based on the economic theory of labor supply and occupational choice. This theory postulates that, faced with alternative occupational choices, an individual will select the option providing the greatest expected lifetime utility or satisfaction [Ref. 7:pp. 257-258]. This criterion is expressed in terms of the monetary benefits for each alternative. Non-pecuniary differences between occupations are also incorporated in the analysis to account for the effects of observed and unobserved individual tastes and family circumstances that affect the

selection of an occupation. By applying this theory to the VSI/SSB program, we hypothesize that those individuals who take the separation payment do so because they expect the present value of their future earnings to be greater if they leave the military than if they stay.

C. RESEARCH QUESTIONS

The thesis attempts to answer the following questions:

1. Can forecasting equations be developed that can be used in future planning iterations for the VSI/SSB Program by Marine Corps manpower planners?

2. What variables should be used for the multivariate models that explain program choice behavior?

3. What estimation technique should be used to model program choice behavior?

4. What are the estimated independent effects of the variables selected for the model?

5. Which models provide the "best fit" for explaining choice behavior?

6. Is a technique available to validate the estimated models?

D. SCOPE OF THESIS

The analysis focuses only on enlisted Marines who were eligible for the VSI/SSB program during the phase I, II, and III offerings. Although officers (majors and lieutenant colonels) were eligible for the program (but under a different set of criteria) officer data are not analyzed. Officers are also excluded from the analysis because so few have applied for the program.

The data used to develop the estimating models were obtained from the enlisted master file located at Marine Corps Headquarters in Washington, D.C. The data include socioeconomic, demographic, and military background information on all marines who were eligible for the program. Program response variables were merged with the Headquarters Master File into a SAS data set.

E. METHODOLOGY

The independent variables used to model individual choice behavior for the VSI/SSB program are socioeconomic variables that reflect an individual's potential lifetime earnings (e.g., race, gender, education, and civilian labor force experience) and variables that represent individual preferences, ability, and family background. The dependent variable in the analysis measures each individual's decision whether to participate in the VSI/SSB program, and in which program.

Econometric modeling techniques are used to develop "best fit" equations to forecast VSI/SSB response rates. Statistical analyses were conducted to measure the independent effect of each explanatory variable on the stay or leave decision.

F. LITERATURE REVIEW

The conceptual foundation for the thesis is provided by previous studies in labor economics. The economic theory of labor supply and occupational choice is used to establish the theoretical framework for the study. Since this is a recent area of research, there are few studies that directly investigate separation incentives. There are, however,

numerous studies that model job-choice behavior. A sampling of these are reviewed in Chapter II.

Factors that have been investigated, and models that have been developed by both civilian and military researchers in their analyses of personnel turnover, retention, and the effects of reenlistment bonuses are explored. These studies all examine the stay-or-leave decision from various perspectives. Variables used to explain the stay-or-leave decision in previous studies supplied the justification for the variables used in the analysis of VSI/SSB "take-rates." Additionally, the modeling techniques found in these studies were used as the basis for the models developed in this thesis.

G. ORGANIZATION OF STUDY

Chapter II presents a detailed literature review that establishes the theoretical framework for the thesis. Turnover, retention, and reenlistment bonus studies are evaluated to demonstrate how the factors used in these studies are related to factors that determine choice behavior for the VSI/SSB.

Chapter III develops the research questions of the thesis, describes the data, and explains the methodology applied in the statistical analysis. The chapter also includes a discussion of the limitations and differences in modeling techniques.

Chapter IV provides the analysis of the factors that affect the separation bonus decision. Also included is an interpretation of model estimates and their predictive accuracy.

The final chapter, Chapter V, summarizes the conclusions derived from the results of the model estimations, citing which variables had a significant effect on estimating the "take-rate," the predictive accuracy of the model, and conclusions about the usefulness of the model for predicting future take-rates. A discussion of the strengths and weaknesses of the study and recommendations for future research conclude the thesis.

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

A. BACKGROUND

Since the early 1970s, military manpower planners have been concerned with implementing cost-effective policies to increase the retention of quality personnel and to reduce attrition rates. The emphasis on retention and attrition began with the advent of the All-Volunteer Force (AVF) in 1973 and the sustained build-up during the 1980s. Military planners quickly learned they could not meet their expanding manpower requirements without increasing reenlistments and reducing attrition. Independent of potential or actual manpower shortages, the services' large investments in recruiting and training justified examination of reenlistment and attrition behavior to identify policy alternatives that would achieve higher retention and lower attrition rates.

Civilian and military studies that analyze retention and turnover behavior are numerous. Most of these studies are based on the theory of labor supply and occupational choice. This theoretical model is commonly used by researchers because the decision to leave or stay in the military is viewed as a choice between alternative occupations, military or civilian.

Prior to the recent downsizing, there was little interest or need to conduct studies on incentives that increase the voluntary separation of military personnel. Although the military has experienced major force reductions throughout its history (some much larger

than the current drawdown and most recently at the end of the Vietnam War), no studies were found that analyzed separation behavior or force-reduction policies. One possible explanation for this lack of research may be that the military never had a problem obtaining the number of voluntary separations needed to achieve force-reduction goals.

In the period preceding the AVF, the majority of the military was made up of conscripts and draft-induced volunteers.[2] Since these draftees never chose the military as an occupation in the first place, the military did not need to offer inducements for voluntary separation during force reductions. Additionally, the number of military careerists in earlier periods was much smaller than in today's armed services.

Previous military expansions have usually occurred during time of war or the threat of war. Many of those who volunteered joined with the intent of returning to civilian life once the conflict was over. An example is the massive demobilization at the end of World War II when most people volunteered for military service to participate in the war, not as a career.

Since the institution of the AVF, improvements in military compensation, job satisfaction, prestige, and quality of life have increased the desirability of a career in the military. The military services have also expressed an implicit guarantee of job security as long as the service member maintained the prescribed standards of performance and

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[2]Many people volunteered for military service during the draft era because they believed they would be drafted anyway. In an effort to avoid a particular service or occupation, these people volunteered before they were drafted. If there had not been the threat of being drafted, they probably would not have volunteered for military service.

conduct. For these reasons, a higher proportion of service members view the military as a long-term career and are less likely to leave voluntarily than the volunteers of earlier periods.

The result of the current trend is that the military can no longer depend on voluntary separations to accomplish a sizable force reduction without either forcing personnel to leave involuntarily or offering some form of voluntary separation incentive. Since involuntary separations are politically unacceptable, analysts must now concentrate on the study of separation behavior to determine the effects of different separation incentive policies on voluntary turnover.

Reenlistment, voluntary turnover (attrition), and selective reenlistment bonus (SRB) program studies examine the stay-or-leave decision from various perspectives. Since the decision to take or not take the VSI/SSB program can be viewed as a stay-or-leave decision, the analysis and development of models for the program are based on the same factors used to determine the stay-or-leave decision in these studies. Therefore, studies that model the stay-or-leave decision were reviewed to determine which variables and modeling techniques might be used to model VSI/SSB take rates.

The theory of occupational choice is presented to provide the theoretical background for the study. A sample of retention, turnover, and reenlistment bonus studies are reviewed to examine factors that influence the stay-or-leave decision along with the empirical techniques used in these studies to model the stay-or-leave decision.

B. REVIEW OF ECONOMIC THEORY

The economic theory of occupational choice predicts that individuals will select an occupation providing the largest expected lifetime utility or satisfaction. The assumption that workers are attempting to maximize utility implies that they are interested in both the pecuniary and non-pecuniary aspects of their jobs. On the one hand, we expect that higher compensation levels in an occupation would attract more workers to that occupation (holding all other factors constant). On the other hand, non-pecuniary factors such as occupational tasks and work environment (risk, unpleasantness, etc.) and how they match workers' preferences are also critical elements in the selection of an occupation. The criterion for job selection is thus expressed in terms of the present value of the expected lifetime earnings and non-pecuniary benefits of each alternative. [Ref. 7:p. 258]

Tinney (1991) provides an example of the theoretical model in his study. The author supposes an individual must select an occupation from N alternatives. Each occupation provides earnings during the time he or she is employed. Let Y be the potential lifetime earnings for a given individual, indicated by the index i, if occupation j is selected, where

$$Y_{ij}=y_j(X_i, r_i) \tag{1}$$

Here, X_i includes observed ability indicators and socioeconomic factors (e.g., race, gender, education, experience) that affect the individual's lifetime earnings, and r represents unobserved components of ability.

The value of choosing occupation j is the value now, or present value, of expected future earnings and non-pecuniary benefits in that occupation. Present value is defined according to:

$$V_{ij}=g(Y_{ij}, Z_i, \mu_i) \tag{2}$$

where Z_i represents observed individual taste and family background factors, and u_i captures the unobserved taste and family background effects. In this model, a given individual selects the jth occupation with the highest present value, V^*_i, where

$$V_i^*=\max(V_{i1}, V_{i2}, \ldots, V_{i_n}) \tag{3}$$

[Ref. 8:pp. 13-14]

A model of the decision to leave or stay in the Marine Corps can be derived from the previous model. Applying this model, the value of staying in the Marine Corps, V_{im} (where m=USMC), is the present value of:

1. Military compensation.
2. Expected civilian earnings after separation or retirement from the Marine Corps.
3. The value of non-pecuniary benefits of a Marine Corps career.

From equation (2), this present value is defined according to

$$V_{im}=g(Y_{im}, Z_i, \mu_i) \tag{4}$$

where Y_{im} is the expected earnings over time if a marine stays. Similarly, V_{ic} (where c=civilian occupations), is the present value of civilian occupations that are alternatives to the Marine Corps, is defined as

$$V_{ic}=g(Y_{ic}, Z_i, \mu_i) \tag{5}$$

where Y_{ic} is the expected lifetime earnings if a marine leaves the Marine Corps and enters a civilian occupation instead. Applied to this model, the VSI/SSB separation bonus would be included as part of the expected lifetime earnings if a marine leaves the Marine Corps and enters a civilian occupation.

Equation (3) implies that an individual will remain in the Marine Corps if and only if $V_{im} > V_{ic}$. Otherwise he or she will separate immediately and enter a civilian occupation (i.e., if $V_{ic} > V_{im}$). The selection criteria in this model are defined in terms of probabilities (Pr):

1. Pr (stay in the Marine Corps) = Pr ($V_{im} > V_{ic}$)
2. Pr (leave the Marine Corps) = Pr ($V_{im} < V_{ic}$)

The theoretical model of occupational choice demonstrates that a marine will only choose to take the separation bonus if the added compensation to civilian earnings results in the probability that the present value of a career in the Marine Corps will be less than the present value of a civilian occupation (Pr ($V_{im} < V_{ic}$)).

C. REVIEW OF RETENTION STUDIES

Numerous studies have attempted to empirically estimate the theoretical model outlined in section B. Chow and Polich (1980), for example, assess the influence of various factors on first-term reenlistment by analyzing the reenlistment rates of 4,000 Army, Navy, and Air Force personnel [Ref. 9]. Data were taken from *The 1976 DoD Personnel Survey* of randomly- drawn active-duty service members with an over-sampling

of people who were within on year of the reenlistment point at the time of the survey. The service members were questioned about factors that might influence their reenlistment decision. The respondents were then traced over the subsequent year to determine whether or not they reenlisted. These data allowed the authors to examine the reported behaviors, attitudes, and conditions as predictors of actual reenlistment decisions. A multivariate logit model was constructed using variables from the survey data to predict an individual's probability of reenlistment.

The authors view reenlistment as an occupational choice decision, where the decision to stay or leave is voluntary. However, they recognize there are some demand-side constraints that prevent certain individuals, who would have otherwise stayed, from reenlisting. The factors used to measure the reenlistment decision included variables representing military compensation, civilian earnings opportunity, and "service environment."

A variable was constructed to estimate an individual's annual Regular Military Compensation (RMC) based on pay grade, years of service, and dependency status. Other measures of military compensation included a variable to distinguish between pay given in cash and pay given in-kind (i.e., mess hall, bachelor's quarters, family housing), a variable for individual perceptions of RMC, and a reenlistment bonus variable.

Chow and Polich found that military pay is difficult to measure because it is perceived in many different ways and in general, the value of military compensation is poorly understood by enlisted personnel [Ref. 9:p. 13]. However, their study showed military compensation was a major factor in the stay-or-leave decision.

Variables used to represent civilian earnings opportunities included education, race, sex, mental ability (represented by the Armed Forces Qualification Test or AFQT), and military occupational specialty (or MOS) [Ref. 9:p. 22]. These variables measure the potential of getting a desirable civilian job. The authors hypothesized that the more a person can earn in the civilian sector the less likely he or she is to stay in the military. Also, a person who belongs to a group that has relatively greater difficulty obtaining civilian employment (e.g., women, minorities, non-high school graduates) is more likely to stay in the military.

In addition to examining the effects of pecuniary factors on reenlistment, Chow and Polich attempted to isolate important non-pecuniary variables that could affect reenlistment rates. The service environment variables included whether or not a person was stationed overseas, how long he or she had been separated from the family, rotation frequency, and number of hours worked in a week. These characteristics of military life could set limits to the supply of military personnel or might require greater compensation to retain certain groups.

The authors found that personnel stationed outside the continental United States (CONUS), personnel who have dependents and were separated from their families for over 25 percent of the time due to service assignments, and personnel who worked long work weeks have lower reenlistment rates. The effects of frequent moving seem to be connected with one's preferences for location and general taste for military life. [Ref. 9:p. 24]

The regression results demonstrated that RMC, the difference between perceived and actual RMC, the variable indicating those who had dependents and were living in military housing, reenlistment bonus, female, and non-white were positive and statistically significant at the one-percent level. Service members who were better educated, had higher mental ability, and served either in the Navy or Air Force showed significantly negative association with the reenlistment decision. The signs of these coefficients were all consistent with the authors' expectations.
[Ref. 9:p. 28].

None of the service environment variables showed a large influence on reenlistment decisions. Rotation frequency was the most significant variable at the ten-percent level and had the expected negative sign. The overseas variable was significant but had an unexpected positive coefficient. The family separation variable and hours worked in a week were both significant above the ten-percent level.

The authors concluded that changes in policies affecting family separation, U.S. location, or hours of work would do very little to raise the first-term reenlistment rate. However, we cannot conclude that these variables would have the same effect on the retention of careerists. Since career marines may place a higher value on non-pecuniary factors than do first-termers, a further investigation into the influences of these factors on careerists is required.

Hiller (1982) conducted a study on second-term reenlistment that analyzed the reenlistment behavior of 2,500 careerists from all armed forces in their sixth to tenth year of service [Ref. 10]. The author took data from *The 1978 DoD Survey of Officers*

and Enlisted Personnel to construct multivariate logistic regression models that were used to estimate the probability of reenlistment, and to discover the key determinants of reenlistment intentions. Hiller's study has particular significance because this group's length of service is more closely related to those individuals who were eligible for the VSI/SSB than the first-termers in the Chow and Polich study.

The explanatory variables used in the logit model were of four types: compensation, promotion, location, and job satisfaction. Compensation variables captured current income, potential civilian income, and other aspects of pay. Promotion variables included past and future promotion rates, promotion rates relative to those of peers, and expected time to next promotion. Location variables measured attitudes toward location, housing, rotation, family separation, and also indicated the types of housing and the actual locations. Job satisfaction variables included job classification, hours worked, hours on call, and satisfaction with aspects of the work environment. [Ref. 10:p. V].

Hiller does not include a variable for total military income in his analysis. Instead, he states that military income is determined by years of service (YOS), paygrade, and number of dependents [Ref. 10:p. 19]. The author reasons that, in a cross-section of individuals, all pay variation is due to those factors, rather than to changes in basic pay rates over time.

The author uses YOS to partially reflect current compensation and the present value of the future retirement annuity. Hiller claims the greater the YOS, the greater the present value, and, consequently, the greater the probability of reenlistment. Since the

present value of the lifetime annuity grows as YOS increases, the retirement decision may outweigh other considerations [Ref. 10:p. 18]. Year of Service may also indicate something about one's "taste" for military service. Those with stronger preferences for military service may have reenlisted for longer second terms. The coefficient for YOS may then pick up a combination of compensation and preference factors.

The author also specifies sets of variables that are related to promotion, location, and job satisfaction [Ref. 10:p. 18]. The likelihood of promotion is an important reenlistment factor because it reflects expected future compensation and captures various advantages and satisfactions that depend upon grade and career success. Since location may influence reenlistment attitudes, variables that indicated a foreign location, guaranteed location, frequency of moves, family separation, and happiness with location were included. Job satisfaction variables included individual responses to a number of job satisfaction questions as well as whether an individual was working in the job for which he or she was trained.

The results of the study showed that the pay and promotion variables are most consistently and significantly related to the reenlistment decision. The non-pecuniary variables, location and job satisfaction, showed varying degrees of importance in the reenlistment decision [Ref. 10:p. 33].

Adedeji and Quester (1991) conducted a study to analyze the impact of recent changes in the characteristics of enlisted Marines as well as changes in personnel policies on the reenlistment decision of first-term Marine Corps personnel [Ref. 11]. The authors

noted that, since the early 1980s, significant changes have taken place that could affect the stay-or-leave decision. These changes included:

1. Marines today are smarter and better educated than in the early 1980s.

2. There has been an increase in the marriage and dependency rates for enlisted personnel.

3. First-term enlistment contracts are longer so that Marines average more years of service at the first reenlistment point.

4. There has been an increase in both time-in-service (TIS) and time-in-grade (TIG) for promotions to corporal and sergeant.
   [Ref. 11:p. 1]

The authors used data from *CNA's Longitudinal ARSTAT Tracking File for Enlisted Marines* to conduct their analysis of the reenlistment decision of first-term enlisted Marines. The sample contained approximately 27,000 observations of marines making the decision between fiscal 1980 and fiscal 1990. A binomial logit function was chosen to estimate the probability that a Marine in the sample reenlisted.

The probability of reenlistment was estimated as a function of variables that belonged to one of three categories: background characteristics, variables describing the Marine at the time of the decision, and variables describing the environment at the time of the decision. Background variables included gender, racial/ethnic group, education, test scores at entry, and length of initial obligation. Variables describing the Marine at the time of the decision included age, grade, whether or not an extension was executed before the decision, marital/dependency status, and primary MOS (PMOS). Environmental variables included the civilian unemployment rate, the level of selected

reenlistment bonus (SRB) offered for the individual's PMOS at the time of the decision, and a civilian-to-military pay index.[3] [Ref. 11:p. 18]

The results of the study showed that SRBs have a strong impact on the decision to reenlist. Over the period, 24.6 percent of Marines in MOSs not offered an SRB reenlisted. In contrast, the reenlistment rate for Marines in MOSs offered level-one SRBs was 34.5 percent [Ref. 11:p14].[4] Also, the analysis showed that SRBs had the strongest impact on Marines with the highest scores on the AFQT.

Other variables that achieved high levels of statistical significance and indicated a person was more likely to stay were grade, length of initial enlistment, gender, race, and marital/dependency status. Overall, higher grade, longer initial enlistments, women, blacks, and married individuals were more likely to reenlist. The average reenlistment rate for unmarried Marines was 24.8 percent, while the average rate for Marines who were married or who had dependents was almost 45 percent [Ref. 11:p. 16].

Finally, a one-percentage point increase in the constructed military-to-civilian pay index for first-term personnel was associated with a 0.6-percentage point increase in the reenlistment rate. Similarly, a one-percentage point increase in the 20- to 24-year-old male unemployment rate was associated with a 0.6-percentage point increase in the Marine Corps reenlistment rate. [Ref. 11:p. 35]

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[3]The military-to-civilian pay index reflects the changes in the average levels of military-to-civilian compensation. This pay variable measures some of the impact of pay on the reenlistment decision.

[4]The bonus dollars a Marine will receive is the SRB level multiplied by the Marine's monthly base pay multiplied by the number of years for which the Marine reenlists.

D. REVIEW OF VOLUNTARY TURNOVER STUDIES

In a comprehensive review and critique of literature published through 1981 on the causes of voluntary terminations from the military and the civilian labor force, Stolzenberg and Winkler (1983) attempted to determine which factors best explain "quit" behavior and whether existing research suggests any new policies that might be used to reduce the voluntary turnover rate.

The authors found that pecuniary factors influence the decision to terminate military service, but non-pecuniary factors may rival or exceed the influence of pay and benefits. The complexity of the military compensation system makes its influence on voluntary terminations difficult to calculate. Due to the complexity of the system, most enlisted personnel tend to severely underestimate their true total compensation. Therefore, it is difficult to assess the total effect of compensation on the decision to quit the military or to know if dissatisfaction with non-pecuniary factors also fosters dissatisfaction with compensation. [Ref. 12:p. 41]

The authors also found that military personnel place a higher value on lump-sum bonus payments than on equivalent funds paid out in installments, and that compensation in some forms is more highly valued than equivalent amounts of compensation in other forms. Evidence shows that pay tends to be more important among first-term personnel, while non-pecuniary factors are more important for career personnel. [Ref. 12: p. 61]

The authors concluded that the job security factor does not cause much voluntary turnover from the military. There is no indication that the up-or-out system induces enough uncertainty to cause turnover. However, a caveat to the authors' conclusion is

that the evidence was provided before the beginning of the current downsizing. The recent rise in uncertainty caused by the continuing force reductions may now be enough to have an effect on voluntary terminations.

Buddin (1981) uses data from service records of 1975 non-prior-service accessions to perform a multivariate analysis of post-training attrition in the Army and Air Force[5]. Buddin's analysis includes two general categories of variables: military environment characteristics and individual background characteristics. Military environment variables include duty location, job reassignments, training, and occupational specialty assignments. Individual background characteristics include geographic region origin, age at service entry, education, race, mental ability, and family background characteristics. Buddin's data do not include direct attitudinal measures. He infers that net effects of duty location attrition measure the effects of satisfaction with the duty location. Buddin reports a significant effect of duty location on attrition even after controlling for other variables. [Ref. 13]

A study by Arima (1981) of Navy line officer's reaction to organizational handling of career moves is based on data that include direct measures of satisfaction with assignment to duty stations [Ref. 14]. However, Arima's analysis focuses primarily on satisfaction with the process of making duty assignments, and secondarily on the

[5]In Buddin's study "attrition" refers to early attrition that occurs before the reenlistment decision point. Early attrition is not the same as the decision to leave at the end of one's reenlistment, and it is difficult to discern whether or not early attrition is voluntary.

assignments themselves. He finds that about 5 percent of the variance in intentions to continue military service is explained by satisfaction with the duty assignment process.

Lakhani (1988) conducted a three-stage least squares analysis of 1981 U.S. Army data to relate "quit rates" (leaving at the end of a reenlistment) to retention bonuses and military pay in combat and non-combat MOSs [Ref. 15]. The author hypothesizes that soldiers in combat MOSs receive military specific training whereas non-combat occupations are trained in general skills more readily transferrable to the civilian sector. Therefore, soldiers in combat occupations should respond more readily to financial incentives to reenlist. However, combat occupations involve higher non-pecuniary costs than non-combat occupations due to such demands as arduous physical labor and danger. Therefore, leave rates are likely to be higher. On the other hand, skills gained in combat occupations are not as marketable in the civilian labor force as are those gained in non-combat occupations.

The conclusion drawn from the above hypothesis is that all occupations cannot be placed into a single category without causing aggregation bias.[6] To avoid bias, the author groups occupations into categories which are relatively homogeneous. Jobs are grouped based on similarity of training, job requirements, and working conditions [Ref. 15, p. 433]. Leave rates of each group should respond differently to an increase in bonus, pay, or both.

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[6]Aggregation bias occurs when occupations are not separated into categories. By not controlling for differences in military occupations, the effects of other variables on retention may be over- or underestimated.

The results provide evidence that soldiers with general human capital in non-combat occupations tend to be less influenced by an increase in SRB than soldiers with military specific human capital. Pay is found to have a consistent negative relationship with leave rates in both groups. Stay rates of combat and non-combat personnel in the Army differ more in response to bonuses than to pay level. [Ref. 15:p. 435]

E. REVIEW OF REENLISTMENT BONUS STUDIES

Reenlistment bonus studies may be the best examples of research related to the study of separation bonuses. Both programs, the SRB and the VSI/SSB, offer financial incentives to influence the decision to leave or stay in the Marine Corps. The goal of reenlistment bonuses is to increase the retention of individuals who would otherwise have left the Marine Corps, while the goal of the VSI/SSB program is to increase the voluntary separation of those who would otherwise have stayed. Because both of these programs attempt to influence the same decision using similar means, albeit for the opposite purpose, SRB studies should be useful in determining the important factors and developing a methodology for modeling the VSI/SSB program "take" rates.

Enns (1977) conducted one of the earliest studies that used econometric modeling techniques to estimate the effects of reenlistment bonuses on retention [Ref. 16]. He developed econometric models of reenlistment behavior to measure the overall effectiveness of bonuses on first-term reenlistment rates and to explore the differences in bonus response by branch, type of individual, job characteristics, time period, size of bonus, and manner of payment.

The data covered five years of the variable reenlistment bonus program (VRB) from fiscal 1971 to fiscal 1974 for the Army, Navy, and Air Force.[7] A logistic model was used to estimate the reenlistment rate.

Enns specified variables to control for military pay and individual attributes. Military pay variables included reenlistment bonus, proficiency pay, and base pay. The individual attributes were included in the model to control for a variety of factors that affect the supply response to reenlistment bonuses. He did not use a variable to measure alternative civilian earnings, since variables capturing individual attributes are all correlated with civilian earning opportunities and thus control for this influence. The level of pre-service education has an impact on a person's ability to seek and obtain civilian employment. Differences in mental ability (aptitude test scores), dependency status, or race are likely to affect individual preferences for military life. Finally, a person's age at initial entry into military service may indicate positive or negative views regarding civilian opportunities. [Ref. 16:pp. 12-14]

The regression results showed that the bonus was positive and statistically significant at the five percent level, proficiency pay was positive but statistically insignificant, and basic pay was generally negative. The effects of personal attributes on the supply of reenlistments were generally in line with *a priori* expectations: non-whites

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[7]The Variable Reenlistment Bonus (VRB) program was the predecessor to the Selective Reenlistment Bonus (SRB) program. While differing in some aspects, the VRB and SRB programs have both shared common features: a multiple award level structure and a "selective" application to skills where either high training costs and/or shortages are commonplace.

had higher stay rates than whites; non-high school graduates were more likely to stay than graduates; attending college had a negative effect on reenlistment; mental ability was negative in the Army but mixed in the Navy and the Air Force; and older age at entry was negative in the Air Force and Army but positive in the Navy. [Ref. 16:pp. 15-17]

Hosek and Peterson (1985) studied reenlistment bonuses to determine how successful the reenlistment bonus has been and to what extent reenlistment bonuses actually increase retention rates in the occupations in which they are offered. The retention behavior of men in all MOSs at both first- and second-term decision points was examined. The occupations included the vast majority of military personnel at retention points. Retention rate data were obtained from the Defense Manpower Data Center (DMDC) for each military occupation during the period fiscal 1976 to fiscal 1981. [Ref. 17]

The authors distinguished between two forms of retention: reenlistments and extensions. Eligible persons who approach a retention decision point may either reenlist or extend their current contract. A multinomial logit functional form was used to capture the effect of a given variable on one choice (i.e., reenlistment) while controlling for its impact on the other choices (separation and extension) [Ref. 17:p. 8]. Hosek and Peterson also controlled for simultaneity bias in the relationship between retention rates and bonus levels.[8] The variables used in the model included bonus variables, one for

[8]Simultaneity bias exists because, just as higher bonuses can increase retention rates, a decrease in retention rates can trigger an increase in bonus utilization. Uncorrected simultaneity bias can make bonuses appear less effective than they actually are.

presence of a bonus and one for amount, a military/civilian wage index, unemployment rate for total civilian labor force prior to the start of each six-month period, and several demographic variables (such as the percentage of men without a high school diploma and the percentage of blacks).

The authors found that higher bonus amounts increase the reenlistment rate, decrease the extension rate, and increase the retention rate. A higher unemployment rate produces the same pattern of effects as do higher bonus amounts. Higher bonus rates and higher wages both increase retention and reenlistments, but bonuses increase the average length of commitment. The authors also found that bonuses aid in force- shaping because they are effective in increasing retention selectively by occupation and for specific terms of service. Furthermore, the authors observe that it is conceivable to create a separation bonus in overstrength occupations to achieve force shaping goals. [Ref. 17:p. 20]

Cymrot (1987) used the Annualized Cost of Leaving (ACOL) model to estimate the strength of the relationship between bonus payments and reenlistments in the Marine Corps. ACOL is a multivariate model that has become popular in retention studies. The ACOL model assumes that an individual decides whether to remain in the armed services based on the perceived costs and benefits of the alternatives. This approach assumes that the decision is made based on maximizing one's utility or satisfaction. The ACOL model derives its name from the monetary difference between the expected present value of military and civilian compensation. [Ref. 18:p. 24]

One problem involved with applying the ACOL model is that it does not include non-pecuniary factors even though taste for military service plays an equally important role in the reenlistment decision. Since the value of tastes is not estimated, the model is probabilistic as opposed to deterministic. A deterministic model would predict whether a Marine stays or leaves, while a probabilistic model would estimate the probability of staying or leaving. In a probabilistic model the preferences of each individual are not known, only the overall distribution of preferences. An individual Marine could fall anywhere in the distribution, so the outcome of his or her decision is not known with certainty. [Ref. 18:pp. 25-28]

Creating an empirical model of ACOL encounters the difficulty of measuring ACOL itself. ACOL is the difference between the values of expected military and civilian pay. The pays referred to in the model are streams of future income. The model is specified as

$$ACOL = M + B - C$$

where M is the present discounted expected value of military pay excluding bonuses, B is the present discounted expected value of the bonus, and C is the present discounted expected value of civilian pay. The difficulty arises in determining future incomes and the discount rate.

In the ACOL model, military pay is determined by YOS and rank. Expected civilian pay is estimated from an earnings equation that uses observations of civilian workers only. The explanatory variables in the earnings model include schooling, work experience, AFQT category, industry variables, race, and sex. A difficulty with the

earnings equation is that it does not differentiate civilian opportunities across occupations. Also, the earnings function introduces selectivity bias. Individuals who remain in the service may have certain unobserved characteristics or opportunities that make their civilian wages different from those who leave, but the earnings equation assumes any unobserved characteristics are the same for leavers or stayers. [Ref. 18:pp. 29-31]

Cymrot used data from the *CNA ARSTAT Transaction File* from the beginning of fiscal 1980 to the end of 1985. Those eligible for bonuses were divided into 66 groups to measure the effects of bonus by experience (range of YOS) and skill groups (MOSs requiring similar skills). The ACOL model uses a logistic functional form to estimate the probability of reenlisting. However, Cymrot views retention as having two components, extensions and reenlistments. Therefore, the model is estimated sequentially. The first equation distinguishes between staying or leaving and the second equation, conditional on staying in the first stage, distinguishes between extending and reenlisting. [Ref. 18:p. 27]

Overall, the study showed that bonuses have a positive effect on reenlistment rates. Marines in skill families with different YOSs did not react the same to reenlistment bonuses. Individuals with 2-6 YOS in skills with close civilian counterparts were most affected by bonuses. Marines in experience zones with 2-6 YOS and 6-10 YOS were the most sensitive to bonuses. Those with 10-14 YOS were less influenced by bonuses because they are already influenced to stay by the retirement system. [Ref. 18:pp. 39-45]

Warner and Goldberg (1984) developed an ACOL model to estimate the effects of non-pecuniary factors in the reenlistment decision process [Ref. 19]. Data were taken

from DMDC files on Navy personnel who made a first-term reenlistment decision during the period fiscal 1974 through 1978. Approximately 80 enlisted occupations were reclassified into 16 occupational categories. The proportion of enlisted personnel assigned to sea duty varied between occupational groups from 6.3 percent to 65.8 percent [Ref. 19:p. 30]. In their model, the taste parameters for civilian and military occupations, respectively, are assumed to be normally distributed, unobserved, random variables. The effects of non-pecuniary factors on reenlistment supply elasticities are captured by the variances of these underlying taste distributions. The principal implications concerning supply elasticities are:

1. Reenlistment supply will be more elastic with respect to pay if there is no correlation between taste for military and civilian occupations, and the dispersion of taste factors in the population is small.

2. The greater the correlation in taste between occupations in military and civilian jobs, the more easily occupations in the two sectors can be substituted for one another.

3. The primary non-pecuniary factor present among Navy ratings is the incidence of sea duty, measured by the proportion of time spent at sea. The greater this ratio, the more inelastic reenlistment is with respect to pay. [Ref. 19:p. 28]

Separate probit models of reenlistment were estimated for each of the 16 occupational groups. The estimated increase in reenlistment rates from a one unit increase in SRB multipliers ranged from 1.8 to 5.5 persons-per-hundred eligible to reenlist [Ref 19:p. 33]. The results also support the hypothesis that a higher incidence of sea duty is associated with lower supply elasticities. The correlation between the percentage of personnel assigned sea duty and estimated pay effects, -.49, was statistically significant at the five percent level [Ref. 19:p. 32].

F. CONCLUSIONS

The theory of occupational choice demonstrates that the decision to leave or stay in the Marine Corps is based on three factors: the present value of military compensation; the present value of civilian compensation; and the present value of non-pecuniary factors that determine an individual's taste for military service or civilian work. The major difficulty encountered by researchers was to determine which variables best represent these factors. This problem, along with a lack of data that accurately measure military compensation, civilian compensation, and non-pecuniary factors, required researchers to use innovative modeling techniques that estimated reenlistment probability through the use of proxy variables.

Although researchers found that military compensation is difficult to measure, most generally agreed that paygrade, YOS, dependency status, promotion, proficiency pay, and the reenlistment bonus provided the best measures of the variation in military compensation. Civilian earnings were almost always represented by a group of personal characteristic variables. These proxy variables included education, race, sex, mental ability, and occupational specialty. The ACOL model used an expected civilian wage variable estimated from a civilian earnings function. The problem, however, with the ACOL model was that it assumed the same civilian wage across all occupations.

Non-pecuniary factors were represented by service environment and job satisfaction variables. These variables included family separation, duty location, rotation frequency, YOS, and promotion variables. Additionally, it is important to consider the effect non-

pecuniary factors have on the elasticity of reenlistment supply. The correlation between taste for military and civilian occupations determines the elasticity of the reenlistment supply curve. Therefore, the effect that increases in pay and bonuses have on retention is influenced by non-pecuniary factors.

Another important finding in the review of literature is that the reaction of people to financial incentives tend to vary by their occupation. That is, individuals in one type of occupation may require greater financial incentives to stay than do persons who are in another. Occupations should not be placed into a single category, but should be placed into groups that have similar training, job characteristics, and working conditions.

The studies by Adedeji and Quester (1991) and Cymrot (1987) used time-series data which required the inclusion of several variables controlling for influences on the reenlistment decision that normally change over time. These variables included the unemployment rate, military-to-civilian pay index, and the level of bonus offered for a particular MOS at the time of the decision. All variables indicated a significant effect on the decision to reenlist. However, the data used in this thesis are cross-sectional, which means that there should be little or no variation in the unemployment rate or the military-to-civilian pay index. Any variation that may exist between observations is probably insignificant.

All of the studies reviewed have provided important insights into the factors that may affect an individual's decision to leave or stay in the Marine Corps. These factors, along with the modeling techniques utilized, form the foundation for the variable specification and model development in the thesis.

III. DATA AND METHODOLOGY

This section presents the details of the empirical approach used to model the stay or leave decision of Marines eligible for the VSI/SSB program. The nature of the data set and the specification of the model for this decision are presented. Additionally, the statistical methodology used to conduct the analysis is described along with the estimation technique selected for the final model.

A. DATA SOURCE AND ORGANIZATION

The data for this analysis are taken from the Headquarters Marine Corps enlisted master file. The data include socioeconomic, demographic, and military background information on all enlisted Marines who were eligible for the VSI/SSB during phases I, II, and III of the program. The data obtained from the master file are updated quarterly and are current as of 31 March 1992. A program response variable, indicating whether VSI, SSB, or no program was taken, was merged with each record by social security number, and the data were formed into a SAS data set.[9]

The original data set contained 9,772 observations, representing paygrades E-4 through E-7, and thirty-one of the Marine Corps' thirty-nine occupational fields. Marines with status codes indicating they are being held involuntarily beyond their end of active service (EAS) date for either medical, legal, or other reasons were deleted from the data set. The reason for this deletion is that these Marines were not eligible.

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[9]SAS is the statistical package used for all analyses.

Marines in eight occupational fields were not eligible during the time period covered by the analysis. The non-eligible occupational codes include the following: 23 (ammunition and explosive ordnance disposal); 33 (food service); 34 (auditing, finance, and accounting); 40 (data systems); 41 (Marine Corps exchange); 66 (aviation supply); 68 (weather service); and 73 (air traffic control and enlisted flight crews). The eligible occupational fields and the number of observations in each field are shown in Table 1.

TABLE 1.

NUMBER AND PERCENTAGE DISTRIBUTION OF OBSERVATIONS BY ELIGIBLE OCCUPATION CODE

Occupation (Code/Description)	Number	Percent
Combat		
03 Infantry	2,476	26.5
08 Artillery	260	2.7
18 Tanks and Amphibious Vehicles	24	0.2
Subtotal	2,860	29.5
Adminstration/Supply		
01 Personnel and Adminstration	1,954	20.1
30 Supply Administration	569	5.9
Subtotal	2,523	26.0
Non-technical Combat Service Support		
02 Intelligence	23	0.2
04 Logistics	350	3.6
13 Engineer, construction and equipment	80	0.8
15 Printing and Reproduction	34	0.4
21 Ordance	84	0.9
25 Operational Communications	184	1.9
31 Traffic Management	72	0.7

Source: Marine Corps Headquarters Enlisted Master File (31 March 1992)

TABLE 1. (continued)

Occupation (Code/Description)	Number	Percent
Non-technical Combat Service support		
35 Motor Transport	183	1.9
43 Public Affairs	18	0.2
44 Legal	26	0.3
46 Training and Visual Information	80	0.8
55 Music	8	0.1
57 Nuclear, Biological, Chemical	8	0.1
58 Military Police and Corrections	410	4.2
65 Aviation Ordnance	104	1.1
70 Airfield Services	52	0.5
98 Identifying MOSs	16	0.2
Subtotal	1,732	17.8
Technical Combat Service Support		
11 Utilities	219	2.3
26 Signals Intelligence	16	0.2
28 Data/Communications maintenance	142	1.5
60/61 Aircraft maintenance	1,107	11.4
63/64 Avionics	612	6.3
72 Air controller/Air support	138	1.4
Subtotal	2,589	26.7
Total	9,704	100.0

Source: Marine Corps Headquarters Enlisted Master File (31 March 1992)

After deleting observations containing variables with errors and missing values, the final data set consisted of 9,704 individuals. Overall, there are 1,083 takers in the data set representing 11.2 percent of the eligible population. Among these individuals, 847 (8.7 percent) took the SSB, 236 (2.4 percent) took the VSI, and 8,621 (88.8 percent) made the decision to stay in the Marine Corps.

An important consideration is that the data account only for those individuals who made the decision to take either the VSI or SSB before 30 June 1992. Those who stayed, but may have taken either the VSI or SSB after the cut-off date, are considered "non-takers" (or stayers) in the analysis.

Additionally, the eligibility constraints imposed by the Marine Corps are likely to have excluded some career Marines who would otherwise have chosen the VSI/SSB program if they had been eligible. However, since only a few of the smaller occupational fields were excluded, the number of careerists affected by the eligibility constraints is considered to be small.

Grouping occupational fields assumes that Marines in non-eligible MOSs respond the same to the program as Marines in the eligible occupations within their group. Based on this assumption, the data are considered to be representative of the career enlisted force, and eligibility restrictions (i.e., exclusion of certain occupations) should not result in specification bias. However, any future changes to eligibility or incentive requirements are likely to alter program choice behavior.

B. DATA ELEMENT DESCRIPTION

The variables used in this study are grouped into three general categories previously identified as the key determinants of an individual's choice to leave or stay in the military. The theory of labor supply and occupational choice [Ref. 8] demonstrated that variables representing military compensation, expected civilian earnings, and the value of important non-pecuniary factors are important factors in an

individual's choice of occupation. Studies by Chow and Polich [Ref. 9], Hiller [Ref. 10], and Adedeji and Quester [Ref. 11] establish the basis for the selection of variables that represent each of these categories.

Although military compensation is difficult to measure, the variables selected are those believed to be the best measures of variation in military compensation. These variables include paygrade, proficiency pay, reenlistment bonus, and marital/dependency status.[10]

Three dummy variables are created for paygrades E-4, E-5, and E-7; E-6 is the omitted category. Because paygrade is highly correlated with YOS, it reflects current compensation and also partially reflects the present value of the future retirement annuity. The higher the paygrade, the greater the YOS, and the greater the present value of the retirement benefit. As the present value of retirement increases, it will begin to outweigh other factors and decrease the probability that an individual will take the VSI/SSB program.

A dummy variable (PROPAY) represents whether or not a Marine is receiving proficiency pay in addition to basic pay and allowances. Proficiency pay is awarded to Marines with certain skills (i.e., foreign language, airborne, scuba) or to those serving in a particular billet (i.e., recruiter, drill instructor, Marine security guard). Since

[10]Although Chow and Polich [Ref. 9] and Hiller [Ref. 10] identified YOS as an important variable representing military compensation, it was not used as an explanatory variable in this analysis. Other variables, believed to be more important in explaining choice behavior for the VSI/SSB program, are highly correlated with YOS. Therefore, the YOS variable was excluded to avoid problems associated with multicollinearity.

proficiency pay raises one's level of compensation, a Marine receiving proficiency pay is expected to be less likely to leave.

A dummy variable (BONUS) is used to represent whether or not a Marine received a reenlistment bonus anytime during his or her career. This variable is used to capture the effects of compensation received in addition to regular pay and allowances. Since a reenlistment bonus raises the level of total military compensation, the expectation is that an individual who has received a bonus would be more likely to stay. However, the impact of this variable is somewhat ambigious. It could also indicate that an individual's decision is affected more by pecuniary than non-pecuniary factors. Viewed from this perspective, a reenlistment bonus could indicate a greater likelihood of taking the VSI or SSB.

A set of dummy variables representing an individual's marital/dependency status is used to further capture potential variation in military compensation. Marines who are married and/or have dependents receive higher compensation not only in the form of pay, but also in housing, health care, exchange and commissary benefits, and family services. Marines who are married and/or have dependents are expected to be less likely to leave, since they have a higher level of military compensation than single Marines or those who have no dependents. Three dummy variables representing marital/dependency status include married (MARRIED), single (SINGLE), and single with dependents (S_DEP). The omitted group represents those who are married with dependent children.

Other variables representing potential civilian earnings include education, gender, race, and military occupation. Individuals who belong to groups that have relatively

greater difficulty obtaining civilian employment (e.g., women, minorities, high school drop-outs) are more likely to stay in the military and, therefore, less likely to take the VSI or SSB. Also, certain military occupations are more transferable to the civilian sector depending on the training received and other experiences. Individuals in occupations that are more transferable would be more likely to take the VSI or SSB, since they have a greater chance of obtaining civilian employment. Military occupations may also measure one's ability because of the different requirements (e.g., AFQT scores) for entry into an occupational training program. Individuals in occupations requiring greater ability would be more likely to receive higher civilian wages than those in jobs requiring less ability.

A dummy variable is used in the analysis to control for education level. People with higher levels of education are expected to have greater opportunities for civilian employment and higher expected civilian earnings. In previous retention studies, education level was usually categorized as either high school or non-high school graduate. However, in this study only 30 (or 0.3 percent) of those eligible are non-high school graduates, and 1,065 (or 11.0 percent) have one or more years of college education. These figures illustrate the trend over the last decade that has reduced the number of non-high school graduates and increased the average education level of career enlisted Marines. Therefore, the education dummy variable (COLLEGE) represents the effect of one or more years of college on the decision to take or not take the program.

Dummy variables for blacks (BLACK), other minorities (OTH_MIN), and gender (FEMALE) are also used to represent potential lifetime civilian earnings. The

expectation is that blacks and other minorities are less likely than whites, and women are less likely than men, to take the VSI/SSB.

The large number of occupational fields required grouping them into four occupational categories (See Table 1). The criteria used to group occupations were based on the similarity of training, job requirements, and working conditions. The three occupational categories represented in the model by dummy variables include combat (CMBT), administration and supply (ADMINSUP), and non-technical combat service support (CSS_NT) occupations. The omitted category is technical combat service support.

Variables used to measure non-pecuniary factors affecting job choice behavior include promotion, location, and job satisfaction. An individual with better promotion opportunities is more likely to stay in the Marine Corps than an individual with lower prospects for promotion. Promotion affects an individual's satisfaction and also reflects expected future military earnings.

A continuous variable measuring the number of years or time-in-grade (TIG) is used to determine how close a Marine is to the next promotion. As time-in-grade increases, the possibility of promotion increases as well as total military compensation. Therefore, the expectation is that a Marine will be less likely to take the VSI/SSB as time-in-grade increases.

A promotion index variable (PRO_IND) was created as a means to control for the effect of a Marine's relative rate of promotion. The index is a ratio of a Marine's time-in-service at his or her last promotion and the average time-in-service at the last

promotion for Marines in the same grade and occupational category. A Marine with an index less than one was promoted to his or her current grade at a faster rate than the average Marine in his or her peer group. Conversely, an index greater than one indicates a slower promotion rate than that of a Marine's peers. An index equal to one indicates the Marine was promoted at the average rate for a particular grade and occupational group. The expectation is that Marines with a faster promotion rate are more likely to stay in service due to higher levels of total military compensation and greater job satisfaction. However. individuals who are promoted faster may also have greater ability and civilian employment potential and, therefore, may be more likely to leave.

A set of dummy variables was used to measure the effects of job location and type of duty on the Marine's decision to take the VSI/SSB. These variables reflect whether or not the Marine is presently in the Fleet Marine Force (FMF) and, if so, whether that individual is assigned to the Atlantic or Pacific FMF. The Atlantic FMF (FMF_LANT) variable includes the assignment to an East Coast FMF unit or assignment overseas in Europe or the Mediterranean. The omitted variable, Pacific FMF, includes West Coast FMF units as well as Hawaii, Okinawa, and other pacific overseas locations. This variable not only takes into account geographic location, but also controls for the effects of duty assignment and a higher incidence of family separation in FMF units. The variable NON_FMF is the third category, and includes all Marines not assigned to FMF units.

Two variables were created to control for factors that are related to an individual's job satisfaction and job security. The variable INMOS is a dummy variable that indicates whether or not a Marine is presently serving in the primary occupation for which he or she was trained. The primary MOS of each Marine was compared to his or her current billet MOS. A match indicates that these individuals are currently serving in their primary occupation. The underlying theory is that individuals will be more satisfied and more likely to stay in the Marine Corps if they are working in the occupation for which they were trained. This hypothesis assumes that individuals always prefer an assignment in their primary occupation over an assignment in a billet outside of their primary MOS (i.e., recruiting, drill instructor, etc.).

The second variable is a measure of one's feelings of job security based on the number of years until the end of active service. The variable YRS_EAS measures the number of years a Marine has remaining on his or her enlistment contract. Those who have a longer period of time remaining may place a higher value on job security than do those with less time until their end of active service (EAS). In some cases, the current enlistment may end after 20 years of service (YOS), when retirement benefits begin. Those with longer contracts are more likely to reach 20 YOS and would be attracted to stay in the Marine Corps by the retirement annuity. Additionally, those with more time left on their contracts may have reenlisted for longer periods because of a higher level of job satisfaction.

Individuals closer to their EAS may believe they should take the VSI/SSB because they may otherwise not be eligible for reenlistment when their current contract expires. They may view the VSI/SSB as a one-time offer before they are forced to leave.

In summary, the explanatory variables selected to model the decision include: (1) paygrade; (2) whether or not the individual is receiving proficiency pay; (3) whether or not the individual received a reenlistment bonus; (4) marital/dependency status; (5) time-in-grade; (6) a relative promotion index; (7) whether or not an individual has any college education; (8) race; (9) gender; (10) military occupation; (11) whether or not the individual is currently serving in his or her occupational specialty; (12) geographic location and duty assignment; and (13) the number of years remaining until the Marine's EAS.

C. MODEL SELECTION

The model analyzes factors believed to affect the probability that an eligible Marine will take the separation bonus. To stay or leave represents a discrete, dichotomous decision. Since the dependent variable reflects this decision, it is treated as a dummy variable where those who leave receive a value of zero and those who stay are assigned a value of one.[11] Because the dependent variable is limited to zero or one, predicted

[11]"Leavers" refer to those who take the VSI/SSB and "stayers" are those who do not take the program.

values of the dependent variable can be calculated to represent the probability of taking the program.[12]

Two functional forms frequently used to estimate equations with dummy dependent variables are the linear probability and the binomial logit models. Both of these models attempt to predict the outcome of the dependent variable, given one or more independent factors. Each functional form has certain advantages and can be used more accurately, given a correct interpretation of the underlying relationship between the dependent and independent variables in the model.

The linear probability model is derived from the fact that the right-hand side of the equation is linear, while the expected value of the left side is a probability:

$$P_i = \beta_0 + \beta_i X_i + \epsilon_i$$

where P_i is the dummy dependent variable, the betas are the regression coefficients, the X_i's are the independent variables, and epsilon represents the stochastic error term.

The linear probability form is the easiest to calculate and to interpret, provided the estimated coefficients can be interpreted to represent the change in the probability of being a "taker" given the explanatory variable. Since the expected value of P_i is a probability, the estimated value of P_i should be within a range of zero to one. However,

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[12]The SAS program uses an ordered value approach, where the lower value is considered "the event" and the higher value is considered "no event". In this analysis, taking the program is considered "the event". Therefore, "takers" must be coded zero in order for the model to estimate the probability of taking the VSI or SSB [Ref. 20:p. 1072].

depending on the values of the X's and their coefficients, the predicted probabilities may fall outside this range. One solution to this problem would be to assign all values greater than one a probability of one and all values less than zero a probability of zero [Ref. 21:p. 512]. Another solution to the problem of estimating probabilities outside the zero to one range is to transform the linear model in such a way so that all predictions will lie within the (0,1) interval.

The binomial logit model is an estimation technique that can be used for equations with dummy dependent variables that avoids the problem of the linear probability model. The probability of taking the VSI/SSB program can thus be estimated using the binomial logit model:

$$P_i = \frac{1}{1 + e^{-(\beta_0 + \beta_i X_i + \epsilon_i)}}$$

where P_i is the probability the ith person is a "taker", the betas are the parameter estimates, the X_i's are the independent variables, and epsilon is the stochastic error term. The logit equation is nonlinear and estimates a gently sloped S-shaped curve between the probability bounds of zero and one [Ref. 21:pp. 518-520]. The coefficients in the model

can be used to measure the elasticities for each independent variable or to estimate the "take" probabilities for different categories of Marines.[13]

The question of the independent effects of the explanatory variables and the problem of multicollinearity were less of a concern. since the primary criterion for model selection was based on goodness of fit. For models with a dummy dependent variable, the logit model provides a better means to measure the overall fit. The linear probability model provides very little information about how well the model explains the choices of Marines. Nevertheless, the linear probability model was calculated using the same explanatory variables that are in the logit model to test for multicollinearity between independent variables and as a benchmark for the logit model. Linear probability estimates are contained in Appendix A and Appendix B.

In a recent study of reenlistment bonuses, Cymrot contends that the decision to reenlist has two components, extensions and reenlistments [Ref. 18]. Similarly, the decision to take the VSI/SSB has two components, take the VSI or take the SSB. Therefore, as in Cymrot's analysis, the model is estimated sequentially.

The first equation distinguishes between takers and non-takers, and the second equation is used only for the sample of takers to differentiate between those who take the VSI and those who take the SSB. The second model is used to determine if there are

[13]The general definition of elasticity is the ratio of the percentage change in the dependent variable divided by the percentage change in the independent variable. Elasticities are unitless measures of the sensitivity of one variable to another [Ref. 18: p. 37].

differences between the characteristics of those who choose the VSI and those who choose the SSB.

In the second equation the dependent variable represents the probability that an individual takes the SSB. Therefore, the dependent variable is assigned a value of one for those who take the VSI and a value of zero for those who take the SSB. Also, the independent variables used in the second equation are the same as those used in the first equation.

IV. DATA ANALYSIS AND INTERPRETATION

This chapter provides a descriptive analysis of the factors that affect the decision to take or not take the VSI/SSB. Also included is the interpretation of the model estimates, an explanation of how take-rates are measured, and the predictive accuracy of the models.

A. BIVARIATE ANALYSIS

Table 2 provides the descriptive characteristics of the Marines in the data set. There are 1,083 program takers and 8,621 stayers for an average take-rate of 11.2 percent among the eligible Marines who were offered the VSI/SSB between 15 January and 30 June 1992. The explanatory variables used to model the decision, the percentage of eligible Marines represented by a particular characteristic, and the take-rate for each characteristic are presented in Table 2.

The purpose for examining the differences in the take-rates shown in these tabulations is to determine whether the percentage of takers, given a particular characteristic, are consistent with previous expectations. Additionally, these rates can provide some indication of the potential effect each independent variable will have on the probability of taking the VSI/SSB in the multivariate model.

TABLE 2.

SELECTED CHARACTERISTICS OF MARINES ELIGIBLE FOR THE VSI/SSB AND CORRESPONDING TAKE-RATES

Characteristic	Percent of eligible Marines	Take-rate (%)
Overall Average		11.2
Paygrade		
E4	2.8	42.5
E5	17.4	26.9
E6	53.1	8.1
E7	26.6	3.6
Proficiency pay	13.2	9.0
No proficiency pay	86.8	11.4
Reenlistment bonus	74.0	10.7
No reenlistment bonus	26.0	12.6
Marital/Dependency status		
single, no dependents	8.4	14.4
single, dependents	7.2	9.7
married, no children	13.7	13.1
married, children	70.7	10.5
Gender		
Male	94.7	11.1
Female	5.3	12.6
Race		
White	64.2	12.6
Black	29.2	8.0
Other minorities	6.6	10.9
Education		
College	11.0	9.1
No college	89.0	11.4

Source: Marine Corps Headquarters Enlisted Master File (31 March 1992)

TABLE 2. (continued)

Characteristic	Percent of Eligible Marines	Take-Rate (%)
Working in MOS	74.0	11.8
Not working in MOS	26.0	9.9
Location/Assignment		
Non-FMF	48.5	10.8
FMF Atlantic	21.3	13.6
FMF Pacific	30.2	9.9
Occupation Group		
Administration/Supply	26.0	7.0
Combat	29.5	5.3
Combat Service Support		
Non-technical	17.8	9.6
Technical	26.7	22.6

Source: Marine Corps Headquarters Enlisted Master File (31 March 1992)

The first characteristic displayed in Table 2 is the distribution of paygrades. As expected, Marines in the lower paygrades were more likely to take the VSI/SSB. While 42.5 percent of E-4s and 26.9 percent of E-5s took the separation bonus, only 8.1 percent of E-6s and 3.6 percent of E-7s were takers. Although the proportion of eligibles who are E-4s is very small (only 2.8 percent), this group had the highest take-rate. Eligible E-6s, who made up over 50 percent of eligible Marines, had the second lowest percentage of takers.

The table reveals a strong impact of paygrade on the decision to take the VSI/SSB. The difference in take-rates shows that, on average, E-4s have a 15.6 percent higher rate

than E-5s, and E-5s have an 18.8 percent higher rate than E-6s. However, the difference in the average take-rate for E-6s is only 4.5 percentage points higher than for E-7s.

The next characteristic is whether or not the Marine is receiving proficiency pay. Again, the results confirm expectations: Marines receiving proficiency pay had a lower than average take-rate (9.0 percent), but the difference in take-rates is only 2.4 percent for Marines with proficiency pay than for Marines without it.

The reenlistment bonus variable also confirms *a priori* expectations. Marines with a reenlistment bonus had a 10.7 percent take-rate, and those who did not receive a bonus had a take-rate of 12.6 percent. Although this characteristic meets expectations, there is less than a 2.0 percentage point difference between bonus recipients and non-recipients.

The rates in Table 2 confirm expectations for marital/dependency status and are mostly consistent with results from previous research findings on the effects of marital/dependency status on the stay or leave decision [Ref. 11]. This variable was hypothesized to capture the effects of the additional benefits a Marine who is married and with dependents receives from staying in the Marine Corps. The majority of eligible Marines are married with dependent children (70.7 percent) and, as expected, have a lower than average take-rate of 10.5 percent. Single Marines with no dependents make up only 8.4 percent of eligible Marines but have an above average take-rate of 14.4 percent. Single Marines with dependents are the smallest proportion of eligible Marines and have the lowest take-rate (9.7 percent) of those with this attribute. Married Marines

with no children make up 13.7 percent of the eligible Marines, with 13.1 percent of the Marines in this category taking the program.

Differences in take-rates for individual background characteristics include slightly higher than average rates for women, lower rates for blacks and other minorities, and lower take-rates for those with college education. The take-rates for women and Marines who never attended college were expected to be lower than the rates for men and those who attended college. However, blacks and other minorities meet expectations of having lower rates.

Marines working in their primary MOS have a 2.5 percent higher average take-rate than Marines who are not in their primary MOS. This variable has the opposite correlation of that expected. Location/duty assignment indicates that Marines in non-FMF and FMF Pacific units have lower than average take-rates, and Marines in FMF Atlantic units have higher than average take-rates.

Although combat is the largest occupation group among eligible Marines (29.5 percent), it has the lowest percentage of takers (5.3 percent). The technical combat service support occupational category is the second largest group at 26.7 percent of eligible Marines and has the highest take-rate at 22.6 percent. These percentages indicate that occupation also has a strong impact on the decision. The 22.6 percent take-rate for Marines in technical combat service support MOSs is more than twice the average. However, the 5.3 percent take-rate for Marines in combat occupations is approximately one-half the average rate.

Since Marine Corps strategy is to target occupations and certain paygrades within occupations, a cross-tabulation of the data, taking into account both characteristics, was conducted. Table 3 shows the percentage of eligible Marines by paygrade and

TABLE 3.

PERCENT OF MARINES ELIGIBLE FOR THE VIS/SSB BY PAYGRADE AND OCCUPATION

	PAYGRADE				
OCCUPATION	E-4	E-5	E-6	E-7	TOTAL
ADMIN/SUPPLY	0.27	2.25	15.28	8.20	26.00
COMBAT	0.02	2.60	18.47	8.39	29.57
CSS NON-TECH	0.92	4.53	6.46	5.94	17.85
CSS TECH	1.63	8.02	12.93	4.10	26.68
TOTAL	2.84	17.40	53.14	26.63	100.00

Source: Headquarters Marine Corps Enlisted Master File (31 March 1992)

occupational category. This table reveals that, overall, E-6s have the most observations in all occupational groups. While E-4s and E-5s are most frequently found in the technical and non-technical combat service support occupations, eligible E-6s and E-7s are most frequently represented in administration/supply and combat occupations.

Table 4 shows the cross-tabulation of take-rates for each occupation group and paygrade. As expected, E-4s have the highest take-rate in each category. The only exception is in the combat occupation where no E-4s are represented. The take-rates for E-5s are the next highest in each category followed by E-6s, and finally, E-7s. Among

occupational categories, technical combat service support (CSS TECH) has the highest take-rate for all paygrades, varying from a high of 55.7 percent for E-4s to a low of 7.0 percent for E-7s. The combat occupation category has the lowest take-rate for all paygrades except E-5s, in which non-technical combat service support (CSS NON-TECH) is the lowest rate at 16.4 percent.

TABLE 4.

PERCENT OF VSI/SSB TAKERS BY PAYGRADE AND OCCUPATION

	PAYGRADE				
OCCUPATION	E-4	E-5	E-6	E-7	AVERAGE
ADMIN/SUPPLY	23.0	19.3	7.0	3.1	7.0
COMBAT	0.0	17.0	5.0	2.4	5.3
CSS NON-TECH	25.8	16.4	8.4	3.3	9.6
CSS TECH	55.7	38.2	13.8	7.0	22.6
AVERAGE	42.5	26.9	8.1	3.6	11.2

Source: Headquarters Marine Corps Enlisted Master File (31 March 1992)

Since there are only two observations in the data for E-4 combat occupations, the 0.0 percent take-rate is not believed to accurately represent the average take-rate for E-4s in this category. If more E-4s in the combat occupations were eligible, the same pattern of higher take-rates for E-4s would most likely occur.

Table 5 shows the bivariate pattern of take-rates by paygrade and occupation for the SSB program. Of the 1,083 takers in the data, 78.2 percent of selected the SSB. Differences across MOSs are very small: there is only a difference of 5.7 percentage

points between the highest average take-rate in the technical combat service support occupations (80.2 percent) and the lowest take-rate in the combat occupations (74.5 percent). However, between paygrades, the difference between SSB take-rates is much greater. On average, E-4s have the highest rate at 91.5 percent while E-7s have the lowest rate at 65.2 percent. Over all occupations, E-4s and E-5s have higher takes-rates for the SSB than do E-6s and E-7s.

TABLE 5

PERCENT OF SSB TAKERS BY PAYGRADE AND OCCUPATION

	PAYGRADE				
OCCUPATION	E4	E5	E6	E7	AVERAGE
ADMIN/SUPPLY	100.0	90.0	72.1	68.0	76.8
COMBAT	0.0	86.0	71.1	65.0	74.5
CSS NON-TECH	100.0	75.0	73.5	57.9	76.0
CSS TECH	88.6	84.5	70.5	67.8	80.2
AVERAGE	91.5	83.7	71.4	65.2	78.2

Source: Marine Corps Headquarters Enlisted Master File (31 March 1992)

While tabulations of VSI/SSB take-rates by different characteristics of Marines can provide considerable insight into the factors associated with program choice behavior, they can also distort the relationships among variables that are important to Marine Corps planners. For example, there is virtually no difference in the average values of the promotion index variable (PRO_IND) for Marines who took the VSI/SSB and those who stayed in the Marine Corps (.997 versus .975). However, previous research findings

indicate a strong relationship between an individual's promotion history and his or her decision to stay or leave [Ref. 10]. To obtain valid estimates of take-rate probabilities and the effects of certain characteristics on the decision, the results of the multivariate models need to be examined.

B. MODEL RESULTS

The results in the previous section provided a bivariate analysis of variables identified as potentially important determinants of the decision to take the VSI/SSB. This analysis demonstrated the differences in average take-rates for individual characteristics while other factors were allowed to vary. However, bivariate analysis does not take into account the relative importance of all factors, nor does it provide estimates of the changes in take-rates when one variable is changed while holding the other factors constant.

This section analyzes the results from a multivariate model for the purpose of determining which variables have a significant effect on the decision to take or not to take the VSI/SSB. Also, the logit model can be used to produce estimates of the probability of a taker choosing the SSB.

The results of estimating the logit model are displayed in Table 6. For the variables representing military compensation, only the paygrade variables demonstrate a significant effect on the decision to take the VSI/SSB program. The positive coefficients for E-4s and E-5s confirm the belief that individuals in lower paygrades are

TABLE 6.

LOGIT RESULTS OF THE VSI/SSB "TAKE" MODEL

Variable	Coefficient	STD Error	Chi- Square	Pr > Chi-square
Intercept	-0.368	0.278	1.664	0.1971
E4	1.340	0.153	77.215	0.0001*
E5	1.026	0.087	139.764	0.0001*
E7	-1.000	0.121	67.769	0.0001*
PROPAY	-0.051	0.119	0.181	0.6710
BONUS	0.057	0.082	0.482	0.4875
SINGLE	0.052	0.118	0.193	0.6605
MARRIED	-0.008	0.100	0.006	0.9399
S_DEP	-0.118	0.145	0.888	0.4153
COLLEGE	-0.157	0.123	1.667	0.1967
FEMALE	0.362	0.155	5.437	0.0197**
BLACK	-0.364	0.086	17.967	0.0001*
OTH_MIN	-0.050	0.144	0.123	0.7264
ADMINSUP	-0.898	0.104	74.194	0.0001*
CMBT	-1.083	0.104	108.135	0.0001*
CSS_NT	-0.934	0.102	84.712	0.0001*
TIG	-0.110	0.018	37.606	0.0001*
PRO_IND	-0.702	0.174	16.318	0.0001*
INMOS	0.184	0.091	4.065	0.0438**
NON_FMF	0.168	0.085	3.891	0.0485
FMF_LANT	0.236	0.097	5.997	0.0143**
YRS_EAS	-0.227	0.028	65.233	0.0001*

Model Chi-squared= 1071.971 (< 0.0001)
Percent predicted correctly= 73.7

*significant at 1-percent
**significant at 5-percent

more likely to take the program. Also, the negative coefficient for E-7s confirms expectations that Marines in this paygrade are less likely to take the VSI/SSB than the omitted category, E-6s.

Although proficiency pay has the expected negative sign, this variable is not statistically significant. The reenlistment bonus variable has a somewhat surprising positive coefficient, but it is also insignificant. The marital/dependency status variables also do not have a significant effect on the decision to take or not take the program.

Effects of variables representing expected civilian earnings had mixed results. The gender variable revealed that women are more likely than men to take the separation payment. This result is surprising since women tend to earn less than men in the civilian sector and, therefore, would be expected to be less likely to leave the Marine Corps. A possible explanation for the unexpected sign is that there may be an important variable omitted from the model that has a positive influence and is correlated with gender. For example, some women may have been considering leaving the Marine Corps anyway, and the VSI/SSB caused them to make this decision earlier than planned. At the same time, in the post-Desert Storm environment female Marines may have a higher propensity to leave. The reason for the higher rate for women is difficult to interpret without controlling for other variables that could have caused an upward bias in the coefficient for women.

The other variables representing potential civilian earnings indicate that blacks are significantly less likely to take the VSI/SSB than whites, but there is no significant difference between other minorities and whites. The education variable indicates that

those with some college education are less likely to take the VSI/SSB than those without such education. However, this variable is also insignificant.

The occupation variables have the greatest significance among the variables used to proxy expected civilian earnings. Marines in administration/supply, combat, and non-technical combat service support occupations are all significantly less likely than those in technical combat service support occupations to take the VSI/SSB. The higher take-rate for Marines in technical occupations is consistent with expectations. Individuals in these occupations have skills that tend to be more transferable to the civilian sector. Therefore, these Marines may require a higher level of military compensation to stay. The VSI/SSB increases the present value of their expected civilian earnings above their expected military compensation, resulting in a higher probability of leaving the Marine Corps.

Marines in military specific occupations (i.e., infantry, artillery, armor) have fewer transferable skills and, therefore, are likely to have fewer civilian job opportunities. On average, these Marines require a higher level of compensation to be induced to voluntarily leave the Marine Corps.

The promotion variables, time-in-grade (TIG) and the promotion index (PRO_IND), are both significant at the one percent level. However, PRO_IND has an unexpected negative coefficient. This sign indicates that Marines who were promoted to their current paygrade at a slower than average rate for their particular occupational group are less likely to take the separation incentive. A possible reason for this unanticipated negative sign is that individuals with faster promotion rates may have

greater overall ability that could be associated with better civilian employment opportunities than those with lower rates. In this case, the promotion index variable would be a proxy for expected civilian earnings and a lower promotion index should increase the probability of taking the VSI/SSB.

The variable INMOS (whether or not a Marine's billet MOS is the same as his or her primary MOS) is significant at the five percent level, but has an unexpected positive coefficient. This result indicates that Marines working in their primary MOS are more likely to take the VSI/SSB than Marines who are not in their primary MOS. The reason for this discrepancy could be that the model did not control for other factors that may affect an individual's occupational preferences. If certain non-pecuniary factors that cause an individual to prefer one job over another are present in the billet MOS (i.e., fewer family separations, more regular working hours, more autonomy, etc.) but not the primary MOS, then the consequence would be a bias in the coefficient for the INMOS variable. Another explanation is that Marines who are not in their primary MOSs have higher job satisfaction than Marines in their primary occupations.

The variables representing one's preference for location and duty assignment are both positive and significant. Marines in a non-FMF unit show a positive and significant difference (at the ten percent level) than Marines in FMF Pacific units. Those in FMF Atlantic units also demonstrate a positive and significant difference at the five percent level. This variable could indicate that Marines in FMF Pacific units are more satisfied with their location and duty assignment or it could measure differences in how the program has been presented by different unit commanders.

A significantly lower tendency to take the VSI/SSB is found among those who have more time remaining until their EAS. The negative coefficient for YRS_EAS substantiates expectations that the likelihood of taking the VSI/SSB decreases for each additional year remaining on a Marine's enlistment contract.

The results from a logit model that predicts a taker's choice between the VSI and SSB are presented in Table 7. This model estimates the probability of choosing the SSB, conditional on taking the program. Of the 1,083 program takers in the data sample, 847 (or 78.2 percent) chose SSB and 236 (or 21.8 percent) chose the VSI. The same explanatory variables that were used to estimate the probabilities for the take model are also used in this model.

As in the "take" model, the only significant military compensation variable is paygrade. The E-4 and E-5 coefficients are positive and significant at the one percent level. These paygrades have a higher tendency to take the SSB program. The E-7 coefficient is negative and significant at the five percent level which indicates a lower tendency for E-7s to take the SSB than E-6s. Based on the hypothesis that younger people tend to have a higher discount rate, the results are consistent with the belief that junior Marines will take a less amount if it is paid in a lump sum rather than spread out over a number of years. Since paygrade and age are highly correlated, the paygrade variable captures some of the age difference between Marines in different paygrades.

Among the variables used to represent expected civilian earnings, only the variable used for education is significant. The variable for whether or not a Marine has any college education (COLLEGE) is negative and significant at the one percent level.

TABLE 7.

LOGIT RESULTS OF VSI OR SSB DECISION

Variable	Coefficient	STD Error	Chi-Square	Pr > Chi-Square
Intercept	4.119	0.687	35.907	0.0001*
E4	1.154	0.381	9.157	0.0025*
E5	0.649	0.185	12.302	0.0005*
E7	-0.600	0.264	5.176	0.0229**
PROPAY	-0.087	0.274	0.101	0.7511
BONUS	-0.320	0.189	2.855	0.0911
SINGLE	-0.237	0.264	0.803	0.3701
MARRIED	0.104	0.238	0.192	0.6611
S_DEP	-0.298	0.303	0.966	0.3256
COLLEGE	-0.694	0.252	7.608	0.0058*
FEMALE	0.087	0.349	0.062	0.8041
BLACK	0.317	0.207	2.351	0.1252
OTH_MIN	-0.323	0.299	1.162	0.2810
ADMINSUP	-0.159	0.240	0.443	0.5055
CMBT	-0.135	0.236	0.328	0.5668
CSS_NT	-0.262	0.226	1.341	0.2468
TIG	-0.199	0.042	22.231	0.0001*
PRO_IND	-1.631	0.433	14.167	0.0002*
INMOS	-0.267	0.210	1.651	0.1988
NON_FMF	-0.226	0.194	1.361	0.2433
FMF_LANT	-0.204	0.218	0.878	0.3488
YRS_EAS	0.020	0.066	0.094	0.7586

Model Chi-square= 87.584 (< 0.0001)
Percent predicted correctly= 61.4

*significant at 1-percent
**significant at 5-percent

This result indicates that Marines with one or more years of college are less likely to take the SSB. An interpretation of this result is that those with higher education levels may be better able to distinguish between the relative values of the two programs. Since the present value of the VSI is difficult to calculate, an individual with more education may have a better comprehension of each program. Also, those with more education are likely to be older and less present-minded than those with less education.

Time-in-grade (TIG) and the promotion index (PRO_IND) are both negative and statistically significant at the one percent level. The time-in-grade variable indicates a Marine is less likely to take the SSB as time-in-grade increases. The reason for this behavior can also be explained by one's age. As time-in-grade increases, so does the individual's age, and older Marines are expected to take the annuity rather than a lump sum payment. The promotion index also displays a negative tendency for Marines to take the SSB as the index increases. The reason why Marines with slower promotion rates are less likely to take the SSB is difficult to interpret. However, because the promotion index is calculated using time-in-grade and years of service, the likely explanation is that the index is also controlling for age. Other non-pecuniary factors represented by the variables INMOS, NON_FMF, FMF_LANT, and YRS_EAS all have an insignificant effect on the decision between VSI or SSB.

The few significant variables in Table 7 indicate that factors which determine whether a Marine chooses one type of payment over another (VSI or SSB) are not the same as the factors that determine whether an individual takes or does not take the VSI/SSB program. Whereas the decision to take the VSI/SSB is generally considered a

job choice decision, the choice between VSI or SSB tends to be more of a financial one. No prior research was found that attempted to model the decision between alternative financial incentives. However, there is evidence that younger individuals tend to have higher personal discount rates and would, therefore, tend to prefer immediate lump sum payments to payments spread out over a period of time.

To test the hypothesis that younger individuals will prefer lump sum payments, the SSB model was reestimated using a different set of variables that more appropriately explain this decision. In this model, a variable representing the Marine's age (AGE) was substituted for paygrade and the military background variables were removed from the logit equation. The insignificance of most of the military background variables in Table 7 indicate they are probably irrelevant factors in this decision. The reason time-in-grade and the promotion index variables were significant is most likely due to their correlation with age. Certain demographic variables that may also influence one's financial decisions (i.e., marital/dependency status, education, gender, and race), along with age, were kept in the model.

The results in Table 8 confirm expectations that age is an important factor in the decision to take one form of payment over another. Of all the variables in the model, only AGE had any significant effect on the probability of taking the SSB. None of the other demographic variables were statistically significant at conventional significance levels. These results support the argument that younger Marines have higher discount rates which is the main reason why they prefer the SSB over the VSI.

Although this model confirms the hypothesis used to explain the choice between the VSI and SSB, it is not used to forecast take-rates for the SSB. The reason it is not used is because it has a poorer overall fit than the original model and also because it cannot be applied to any particular group that may be targeted for the VSI/SSB program. This model would not allow planners to estimate SSB take-rates for particular paygrades or occupations, since it does not control for these factors. The predicted SSB take probabilities and the explanation of "goodness-of-fit" are presented in the last two sections of this chapter.

TABLE 8.

LOGIT RESULTS FOR THE VSI OR SSB DECISION USING ONLY DEMOGRAPHIC CHARACTERISTICS

Variable	Coefficient	STD Error	Chi-Square	Pr > Chi-Square
Intercept	5.630	0.679	68.671	0.0001*
AGE	-0.139	0.021	43.153	0.0001*
SINGLE	-0.101	0.258	0.153	0.6959
MARRIED	0.032	0.229	0.019	0.8901
S_DEP	-0.375	0.295	1.613	0.2040
COLLEGE	-0.329	0.247	1.789	0.1181
FEMALE	0.092	0.334	0.077	0.7818
BLACK	0.317	0.199	2.533	0.1115
OTH_MIN	-0.299	0.291	1.055	0.3045

Model Chi-square= 58.554 (< 0.0001) *significant at the 1-percent level
Percent predicted correctly= 62.0

C. PREDICTING TAKE-RATES

The previous section presents the results and an interpretation of the explanatory variables in the multivariate models. This section provides a demonstration of how take-rates can be predicted by substituting various combinations of the independent variables into the logit equations and calculating the probabilities. The probabilities generated by the models are the results from this study that can be used to estimate future take-rates for the VSI/SSB program. The advantage of using the multivariate models over the results in Table 2 and Table 3 is that the rates will be adjusted up or down depending upon the level of the other important factors affecting the decision.

To demonstrate how the model predicts take-rates and how these rates can differ significantly from the bivariate results in Table 2, a notional Marine is selected with specific characteristics. In this case, the notional Marine selected for the example represents the average Marine in the data sample. This Marine is characterized as a white man; in paygrade E-6 with three years time-in-grade; two years until EAS; and a promotion index of 1.0. This Marine is married with children; has no college education; is not receiving proficiency pay, but has received a reenlistment bonus; has a primary occupation in the technical combat service support category; and is currently serving in his primary MOS in a FMF Pacific unit.[14]

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[14]Although the highest percentage of eligible Marines in the data were in combat occupations, technical combat service support was chosen for the average Marine because

If Table 2 is used to estimate this Marine's take-rate, then only one of the many characteristics can be used. These rates vary from a low of 8.1 percent for being an E-6 to a high of 22.6 percent for having a technical combat service support occupation. There is no best rate to use from Table 2. The overall average take-rate could be used, but since the Marine Corps' strategy for using the VSI/SSB is to target certain occupations and paygrades within occupations, the bivariate rate that should be used is the average take-rate for technical combat service support occupation. The bivariate take-rate in Table 2 for a Marine with a technical combat service support occupation is 22.6 percent. Because this rate is more than twice the average rate for all Marines in the sample, the likelihood of this rate representing the actual take-rate is not very good.

A better estimate of the take-rate is in Table 4. In this table, occupational group and paygrade are considered together. The new estimate for the notional Marine taken from Table 4 drops dramatically to 13.8 percent, only 2.6 percentage points above the overall average. Although this rate may be a better estimate than the one in Table 2, it still does not take into account the other variables that are known to be important factors in determining one's decision.

The logit model allows numerous important characteristics to be included in the estimation of program take probabilities. The probability that a Marine is a taker is

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women are currently excluded from combat occupations. If combat is used to represent the average Marine, then the difference in predicted probabilities between men and women cannot be calculated.

calculated by substituting the values of the independent variables into the logit equation found in Chapter III.

Using the logit model, the estimated probability of the notional Marine taking the VSI/SSB is 16.6 percent. This estimated probability is 6.0 percentage points less than the rate from Table 2 and 2.8 percentage points higher than the rate from Table 4. Although there is certainly some degree of error in the model, this probability is a closer representation of the actual take-rate. How good of an estimate the model provides is discussed in the next section.

An advantage of the multivariate model is that the magnitude of change in the predicted probability for a given change in a particular characteristic can be calculated. Continuing with the example, the probability of an E-5 taking the VSI/SSB while holding all other factors constant is 35.7 percent. The new rate is 13.1 percentage points higher than the rate for a technical combat service support occupation in Table 2 and 2.5 percentage points lower than the rate shown in Table 3 for E-5s in a technical combat service support occupation. The difference between this probability and the probability estimated for E-6s indicates that E-5s have a 19.1 percent greater probability of taking VSI/SSB than E-6s, holding all other variables constant.

A change in paygrade to E-7, keeping the other variables the same, results in a take probability of 6.8 percent. This rate is 15.8 percentage points lower than the average rate for technical combat service support occupations in Table 2, but is only 0.2 percent lower than the rate in Table 3 for E-7s in technical combat service support occupations.

The difference between the probabilities for E-6 and E-7 reveal that E-7s with the same characteristics are 9.8 percent less likely than E-6s to take the VSI/SSB.

Finally, by substituting E4 into the model, the probability changes to 43.2 percent. This rate is 20.6 percentage points higher than the rate taken from Table 2 and 12.5 percentage points lower than the rate in Table 3 for E-4s in a technical combat service support occupation. The difference in probabilities between E-4s and E-6s holding other factors constant is 26.6 percentage points.

Table 9 reveals the predicted probabilities for different combinations of paygrade and occupational group while holding constant the other characteristics. Figure 1 is a graphic representation of the predicted probabilities that provides a comparison of take-rates by paygrade and occupation categories.

TABLE 9.

PREDICTED VSI/SSB TAKE PROBABILITIES BY PAYGRADE AND OCCUPATION, HOLDING OTHER FACTORS CONSTANT FOR THE AVERAGE MARINE

	PAYGRADE			
OCCUPATION	E4	E5	E6	E7
ADMINSUP	23.7	18.5	7.5	2.9
COMBAT	20.5	15.8	6.3	2.4
CSS_NT	23.0	17.9	7.2	2.8
CSS_TECH	43.2	35.7	16.6	6.8

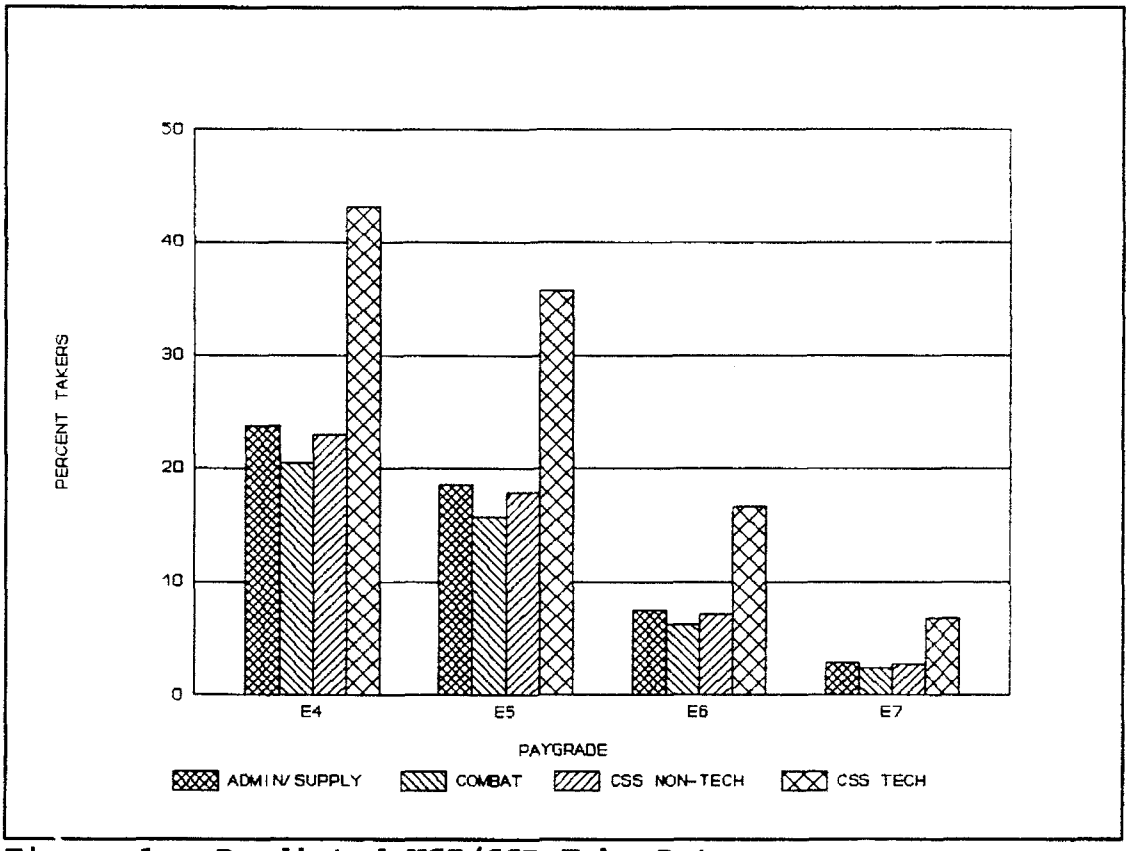

Figure 1. Predicted VSI/SSB Take-Rates

The estimated probabilities from the multivariate model shown in Table 9 do not differ greatly from the bivariate results in Table 4 except in the case of E-4s. These results provide evidence that paygrade and occupation are the most important variables in the model and that other significant factors have only small marginal effects on predicted probabilities.

The other significant variables in the model have varying degrees of signif ıce, but overall did not have great effects on the predicted probabilities. The magnitudes of effects for each of the other significant variables were measured by keeping the same variables constant for the average Marine in the data.

The largest change in predicted probability was associated with the gender variable: women had a take probability that was 5.7 percentage points higher than that for men with the same characteristics. The next most significant variable was race: blacks revealed a predicted probability that was 4.4 percentage points lower than whites with the same characteristics. For each additional year the average Marine had until his EAS, the predicted probability decreased by 2.9 percentage points. A Marine in an east coast FMF unit had a predicted probability 3.4 percentage points higher than the average Marine in a west coast FMF unit. The average Marine not in his primary MOS had a predicted probability 2.2 percentage points lower than a Marine serving in his primary occupation. Finally, the predicted probability of taking the VSI/SSB decreases 1.5 percentage points for each additional year a Marine remains in grade.

The model for determining the probability of selecting the SSB is applied in the same manner as the overall model. Table 10 lists the probabilities of taking the SSB for different paygrades and occupations while the other characteristics are held constant for the average Marine. The probabilities in this table are consistent with the results in Table 7. The small difference in the take-rates for the SSB by occupation illustrates the insignificant effect one's occupation has on the choice between VSI and SSB. However, the difference in probabilities between paygrades are much greater and depict the significant effect paygrade has on the decision to take the SSB.

A comparison of the results in Table 10 to the bivariate estimates in Table 5 reveals that other variables in the model have the greatest effect on influencing the decision of

TABLE 10.

PREDICTED SSB TAKE PROBABILITIES BY PAYGRADE AND OCCUPATION, HOLDING OTHER FACTORS CONSTANT FOR THE AVERAGE MARINE

	PAYGRADE			
OCCUPATION	E4	E5	E6	E7
ADMINSUP	92.7	88.4	79.9	68.3
COMBAT	92.8	88.7	80.3	69.2
CSS_NT	91.9	87.3	78.3	66.4
CSS_TECH	93.7	90.0	82.3	71.9

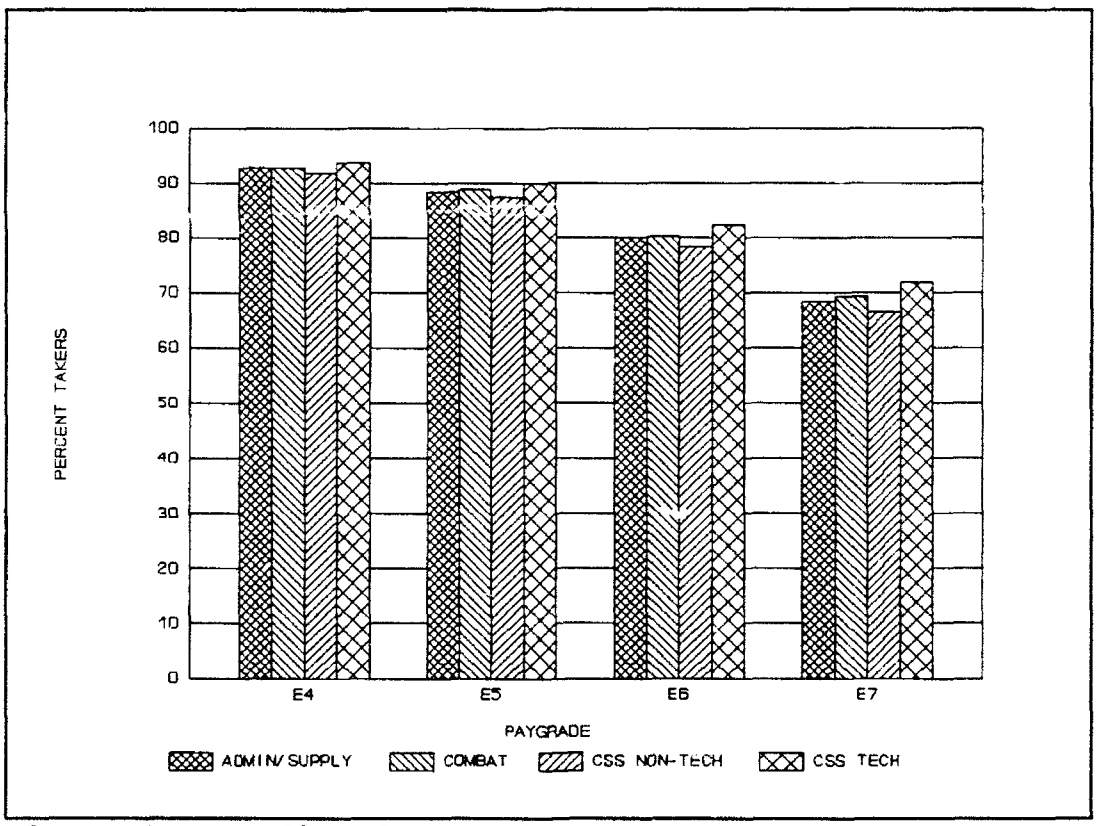

Figure 2. Predicted SSB Take-Rates

E-6s to take the SSB. In all occupations, the predicted probabilities of taking the SSB were much greater for E-6s in the multivariate model than in the bivariate tabulation. Figure 2 provides an illustration of the rates in Table 10 and further reveals the negligible effect that occupation has on the decision to choose the SSB. However, the bar-graph demonstrates that differences in paygrade are an important factor in the decision. E-4s and E-5s in all occupations have higher SSB take-rates than E-6s and E-7s.

D. GOODNESS OF FIT

The previous sections revealed the direction and significance each explanatory variable has on take probabilities, how the models are used to estimate take probabilities, and the magnitude of the effect of each independent variable on predicted probabilities. The remaining question is: how accurate are the models at predicting take probabilities?

Two methods were used to measure the goodness-of-fit of the models. In the logit model, the log-likelihood ratio provides the statistical test of significance for the estimated equation as a whole. Because the log-likelihood statistic follows a chi-square distribution, a chi-square value is used to measure the significance of the model. The chi-square statistics presented in Tables 6 and 7 indicate that both models are statistically significant at less than the one percent level. This result provides evidence that the models have a reasonably good fit of the data. The second goodness-of-fit test for the logit equations is the percentage of cases the logit model correctly predicts. However, because the logit model is probabilistic, it does not determine whether or not a person

VSI/SSB. The model can only estimate the probability that an individual will take the program. Therefore, to determine which Marines are takers and non-takers, a decision must be made regarding the probability level where a Marine is classified as a taker. If the number of takers and non-takers was approximately equal (i.e., about half are takers and half are not), then a .50 probability level would be appropriate. However, because only 11.2 percent of Marines in the data are takers, a .50 probability level classifies everyone in the data as a non-taker.

In an effort to overcome the problem of this highly skewed distribution, the decision was made to classify a Marine as a taker if he or she has an estimated probability that is equal to or greater than the overall average take-rate of 11.2 percent. Similarly, since the average take-rate for the SSB is 78.2 percent, a Marine with a probability of .782 or greater was classified as taking the SSB, and with a rate less than .782 as taking the VSI.

Based on the criteria used to classify Marines as takers or non-takers, the logit model correctly predicted 73.7 percent of the cases. The model predicting the probability of a taker choosing the SSB was correct for 61.4 percent of the cases in the sample. Although these percentages of correct predictions seem reasonably good, the results are misleading. A naive prediction of takers, in which case no one in the data set is predicted to take the VSI/SSB, results in 88.8 percent of the cases correctly predicted. Correspondingly, a naive prediction of takers who select SSB, where all takers are predicted to take the SSB, results in 78.2 percent of the cases correctly predicted.

The initial reaction to the results is that a naive prediction is better than the multivariate model. However, a naive prediction does not provide any information about takers' characteristics. Any model, even a bivariate approach, should be better than a naive prediction. The problem with this test is a consequence of the data set rather than the model. A better result could be obtained from a stratified sample, where the number of takers and non-takers is about the same.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The overall model developed in the thesis revealed that paygrade and occupation are the most important factors for predicting the probability that a Marine takes the VSI/SSB. Junior enlisted Marines in paygrades E-4 and E-5 demonstrated a much greater probability of taking the VSI/SSB than E-6s and E-7s.

The reason for the significant differences between the lower and higher paygrades is a consequence of the greater present value that Marines with more years of service place on the retirement annuity. For the majority of E-6s and E-7s, the value of the VSI/SSB is not great enough to outweigh the benefits of a 20-year retirement. These Marines perceive they are better off by remaining in the Marine Corps. On the other hand, E-4s and E-5s perceive themselves less likely to reach 20 years-of-service, and therefore, they place a lower present value on the retirement benefit. In this instance, the VSI/SSB provides the necessary additional compensation to make leaving the military more worthwhile than staying.

Occupation is the second most important predictor of a Marine's decision to take or not to take the VSI/SSB. Although the majority of eligible Marines were in combat occupations, they were the least likely to take the program. Those in technical occupations were significantly more likely to take the VSI/SSB than were Marines in any

of the other occupational fields. This result was consistent for Marines across all paygrades.

A higher leave rate for Marines in technical occupations is compatible with previous studies conducted on retention and reenlistment bonuses. Individuals in these occupations have skills which tend to be more transferable to the civilian sector. Therefore, these Marines require a higher level of military compensation to encourage them to stay. The VSI/SSB increases the present value of their expected civilian earnings above their expected military compensation resulting in a higher probability of leaving the Marine Corps.

Marines in military-specific occupations (i.e., infantry, artillery, armor) have fewer transferable skills and therefore have fewer civilian job opportunities. On average, these Marines require a higher level of compensation to induce them to voluntarily leave the Marine Corps. Also, Marines who choose military-specific occupations may prefer the military lifestyle more than Marines in technical occupations and, therefore, place a higher non-pecuniary value on their military occupation.

Other significant variables in the model that cause an increase in the predicted probability of taking the VSI/SSB included females, Marines working in their primary MOS, and Marines in east coast FMF units. Blacks, Marines with more time-in-grade, Marines promoted at a slower than average rate, and Marines with more years left until their EAS all had significantly lower predicted probabilities of taking the VSI/SSB. Although these variables were significant to varying degrees, the marginal effects each variable had on the predicted probabilities were small.

In the model used to predict the probability that a Marine who took the program chooses the SSB, only paygrade, time-in-grade, the rate of promotion, and education level were significant. Again, paygrade was the most significant variable in affecting the decision between VSI and SSB. E-4s and E-5s demonstrated a higher predicted probability of taking the SSB than did E-6s and E-7s. This result is consistent with the hypothesis that younger workers have higher discount rates and prefer smaller lump- sum payments over larger payments spread out over many years.

Marines with one or more years of college education had a lower probability of taking the SSB, which may reflect a Marine's ability to calculate the relative value of the two programs. The two promotion variables (time-in-grade and the promotion index) also lowered the probability of taking the SSB. These variables seem to indicate that those who take the VSI are individuals who perceive that their promotion prospects may prevent them from reaching the 20-year retirement, and by taking the VSI they can receive the closest alternative to a retirement annuity.

B. RECOMMENDATIONS

This study has provided important insights into the factors that affect a Marine's decision to take the VSI/SSB. Additionally, the models developed can be used to estimate future take probabilities for different groups of Marines. However, more research still needs to be conducted to determine what other factors may affect this decision, and how effective the program is at achieving the Marine Corps' desired objectives.

The thesis results reveal that the models have a fairly good fit of the data, but a test with a separate data set is required to better validate the accuracy of the models. Also, further analyses are required to determine if the program has attained the desired results. Although the study provides estimated take-rates, it does not take into account how effective the program has been at achieving the Marine Corps' targets. If E-4s and E-5s in technical occupations were not intended to have the highest take-rates, and if Marine Corps planners had hoped to target a large number of E-6s and E-7s in combat occupations for voluntary separation, then the VSI/SSB program may not have been a very effective force- shaping management tool.

In future studies, the need to control for external factors may be required. Previous research has shown that the civilian unemployment rate and the difference between military and civilian pay are important factors in one's decision to leave or stay in the military. Over a period of time, these factors tend to vary more and could have a significant effect on the decision to take the VSI/SSB.

Finally, future studies should investigate the independent effects the VSI/SSB program has on the decision to leave or stay in the Marine Corps. To accurately determine the effectiveness of the program, policy makers need to know the marginal effect the VSI/SSB has on the probability that a Marine stays or leaves. Since Marines in lower paygrades are more likely to take the program, it is important to know how many of the program takers would have separated if they had <u>not</u> been offered the VSI/SSB. There could be a situation where a significant number of Marines took the VSI/SSB as an "economic rent." By comparing VSI/SSB takers and non-takers with a

similar group of Marines who reenlisted or separated prior to the initiation of the VSI/SSB program, an estimate of the independent effect of the VSI/SSB on the stay or leave decision can be measured.

APPENDIX A

LINEAR PROBABILITY RESULTS FOR THE VSI/SSB "TAKE" DECISION

Variable	Coefficient	STD Error	T-Statistic	P-Value
Intercept	-0.691	0.026	-26.214	0.0001
E4	0.266	0.019	13.709	0.0001
E5	0.149	0.009	16.239	0.0001
E7	-0.054	0.007	-7.294	0.0001
PROPAY	-0.007	0.009.	0.763	0.4456
BONUS	0.004	0.007	-0.523	0.6010
SINGLE	0.004	0.011	-0.327	0.7435
MARRIED	-.0001	0.009	-0.084	0.9330
S_DEP	-0.011	0.012	-0.920	0.3577
COLLEGE	-0.014	0.009	-1.462	0.1438
FEMALE	0.034	0.014	2.362	0.0182
BLACK	-0.029	0.006	-4.233	0.0001
OTH_MIN	-0.002	0.012	-0.153	0.8782
ADMINSUP	-0.104	0.009	-11.416	0.0001
CMBT	-0.107	0.008	-12.568	0.0001
CSS_NT	-0.113	0.009	-12.021	0.0001
TIG	-0.010	0.001	-6.906	0.0001
PRO_IND	-0.088	0.017	-5.118	0.0001
INMOS	0.018	0.007	2.347	0.0189
NON_FMF	0.019	0.007	2.608	0.0091
FMF_LANT	0.023	0.008	2.748	0.0060
YRS_EAS	-0.016	0.002	-7.489	0.0001

R-square= 0.1259 Adjusted R-Square= 0.124 F-statistic= 66.415 (< 0.0001)

APPENDIX B

LINEAR PROBABILITY RESULTS FOR THE SSB OR VSI DECISION

Variable	Coefficient	STD Error	T- Statistic	P-Value
Intercept	0.195	0.101	1.936	0.0532
E4	0.153	0.048	3.197	0.0014
E5	0.111	0.029	7.744	0.0002
E7	-0.111	0.048	-2.313	0.0209
PROPAY	-0.008	0.043	-0.193	0.8468
BONUS	-0.045	0.028	-1.601	0.1097
SINGLE	-0.038	0.041	-0.930	0.3526
MARRIED	-0.016	0.036	-0.456	0.6482
S_DEP	-0.053	0.052	-1.019	0.3084
COLLEGE	-0.130	0.044	-2.964	0.0031
FEMALE	0.018	0.056	0.318	0.7508
BLACK	0.048	0.031	1.532	0.1258
OTH_MIN	-0.054	0.051	-1.065	0.2873
ADMINSUP	-0.017	0.039	-0.434	0.6647
CMBT	-0.022	0.039	-0.558	0.5767
CSS_NT	-0.038	0.036	-1.040	0.2986
TIG	-0.033	0.007	-4.976	0.0001
PRO_IND	-0.024	0.064	-3.769	0.0002
INMOS	-0.041	0.032	-1.264	0.2066
NON_FMF	-0.036	0.030	-1.205	0.2284
FMF_LANT	-0.038	0.034	-1.119	0.2635
YRS_EAS	0.004	0.011	0.338	0.7352

R-square= 0.0792 Adjusted R-square= 0.0610 F-statistic= 4.348 (< 0.0001)

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